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SMITHSONIAN INSTITUTION
UNITED STATES NATIONAL MUSEUM
Bulletin 84

A CONTRIBUTION TO THE STUDY OF OPHIURANS
OF THE UNITED STATES NATIONAL MUSEUM

BY

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WASHINGTON
GOVERNMENT PRINTING OFFICE
1914

BULLETIN OF THE UNITED STATES NATIONAL MUSEUM

ISSUED APRIL 9, 1914.

ADVERTISEMENT.

The scientific publications of the United States National Museum consist of two series, the *Proceedings* and the *Bulletins*.

The *Proceedings*, the first volume of which was issued in 1878, are intended primarily as a medium for the publication of original, and usually brief, papers based on the collections of the National Museum, presenting newly acquired facts in zoology, geology, and anthropology, including descriptions of new forms of animals, and revisions of limited groups. One or two volumes are issued annually and distributed to libraries and scientific organizations. A limited number of copies of each paper, in pamphlet form, is distributed to specialists and others interested in the different subjects as soon as printed. The date of publication is printed on each paper, and these dates are also recorded in the tables of contents of the volume.

The *Bulletins*, the first of which was issued in 1875, consist of a series of separate publications comprising chiefly monographs of large zoological groups and other general systematic treatises (occasionally in several volumes), faunal works, reports of expeditions, and catalogues of type-specimens, special collections, etc. The majority of the volumes are octavos, but a quarto size has been adopted in a few instances in which large plates were regarded as indispensable.

Since 1902 a series of octavo volumes containing papers relating to the botanical collections of the Museum, and known as the *Contributions from the National Herbarium*, has been published as bulletins.

The present work forms No. 84 of the *Bulletin* series.

RICHARD RATHBUN,
Assistant Secretary, Smithsonian Institution,
In charge of the United States National Museum.

WASHINGTON, D. C., February 27, 1914.

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A CONTRIBUTION TO THE STUDY OF THE OPHIURANS OF THE UNITED STATES NATIONAL MUSEUM.

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INTRODUCTION.

The United States National Museum has been kind enough to entrust to me the study of a considerable collection of ophiurans coming chiefly from the Caribbean Sea, and including both littoral and deep-sea forms.¹ This collection contains a certain number of new species additional to those already discovered by the United States Coast Survey steamer *Blake* in the same waters. Among the species which are already known, many are very common and offer no special interest, but there are also a good many others the characters of which have not been indicated by the authors in a satisfactory manner, so that I have found it necessary to study them in detail. Among them, I have particularly devoted my attention to the species of *Amphiura* and *Ophiacantha*, both genera being understood in the widest sense. It seemed to me useful not to limit my observations to the species represented in the collection which had been entrusted to me, but to extend them to certain neighboring forms, the knowledge of which was likely to help toward an understanding of the former. I will describe and illustrate these forms in the present paper and I think that I shall not be reproached with having made it too long through such additions.

For such a comparative study, I had to have recourse to the examination of a certain number of type-specimens, the most important and most numerous of which had been described either by Lütken or by Ljungman. These types, which are kept in the Stockholm Museum and in the Copenhagen Museum were most kindly communicated to me by Professor Théel and my very good friend Doctor Mortensen, to whom I beg to tender my best thanks for their kindness. The United States National Museum communicated to me also a few of Professor Verrill's species.

The collection which has been handed to me includes in all 129 species, of which 24 are new. Here is a list of them:

Family OPHIODERMATIDÆ.

Ophioderma oppressa (Say).
Ophioderma brevicauda Lütken.
Ophioderma brevispina (Say).
Ophioderma cinerea Müller and Troschel.
Ophioderma rubicunda Lütken.

Ophioderma variegata Lütken.
Ophioderma clypeata, new species.
Ophioderma, species.
Ophiarachnella ongulata (Lyman).
Bathypectinura tessellata (Lyman).

¹ To complete the published records of West Indian ophiurans in the United States National Museum a list is appended of specimens identified by the Hon. Theodore Lyman but never reported on.

Family OPHIOLEPIDÆ.

Ophiolepis elegans Lütken.
Ophiolepis paucispina (Say).
Ophiozona impressa (Lütken).
Ophiozona nivea var. *compta* Verrill.
Ophiomastus secundus Lyman.
Ophioglypha conveza Lyman.
Ophioglypha coronata, new species.
Ophioglypha elevata Lyman.
Ophioglypha falcifera Lyman.
Ophioglypha fasciculata Lyman.
Ophioglypha inornata Lyman.
Ophioglypha irrorata Lyman.
Ophioglypha lepida Lyman.
Ophioglypha ljungmani Lyman.
Ophioglypha lymani Ljungman.

Ophioglypha robusta (Ayres).
Ophioglypha sarsi (Lütken).
Ophioglypha sculptilis Lyman.
Ophiomusium eburneum Lyman.
Ophiomusium lymant Wyville Thomson.
Ophiomusium planum Lyman.
Ophiomusium rugosum, new species.
Ophiomusium sculptum Verrill.
Ophiomusium serratum Lyman.
Ophiomusium testudo Lyman.
Ophiomusium validum Ljungman.
Ophiomusium armigerum Lyman.
Ophiomisidium speciosum, new species.
Ophiomisidium pulchellum (Wyville Thomson).
Ophiocten hastatum Lyman.

Family AMPHIURIDÆ.

Ophiopholis aculeata (Linnaeus).
Ophiostigma isacanthum (Say).
Hemipholis elongata (Say).
Ophiactis asperula (Philippi).
Ophiactis dispar (Verrill).
Ophiactis duplicata (Lyman).
Ophiactis mülleri Lütken.
Ophiactis savignyi (Müller and Troschel).
Amphilepis norvegica (Ljungman).
Ophiophragmus wundermani (Lyman).
Ophiocnida filogranea Lyman.
Ophiocnida loveni (Ljungman).
Ophiocnida scabriuacula (Lütken).
Amphilimna olivacea (Lyman).
Ophionereis reticulata (Say).
Ophionereis squamulosa, new name.
Ophiopsila rüsei Lütken.
Ophiopsila maculata Verrill.
Amphiura flexuosa Ljungman.
Amphiura latispina Ljungman.

Amphiura rathbuni, new species.
Amphiura kinbergensis, new species.
Amphiura palmeri Lyman.
Amphiura fibulata, new species.
Amphiura kükenhali Kœhler.
Amphiura complanata Ljungman.
Amphiura otteri Ljungman.
Amphiura grandisquama Lyman.
Amphiura stimpsoni Lütken.
Amphiura magellanica Lyman.
Amphiura diducta, new species.
Amphipholis squamata (Delle Chiaje).
Amphipholis tenuispina Ljungman.
Amphipholis gracillima Stimpson.
Amphiodia erecta, new species.
Amphiodia lütkeni (Ljungman).
Amphiodia pulchella (Lyman).
Amphipolus abdita (Verrill).
Amphipolus cuneata (Lyman).

Family OPHIOMYCETIDÆ.

Ophiomyces mirabilis Lyman.

Family OPHIACANTHIDÆ.

Ophiacantha aculeata Verrill.
Ophiacantha anomala Sars.
Ophiacantha aspera Lyman.
Ophiacantha bidentata (Retzius).
Ophiacantha echinulata Lyman.
Ophiacantha enopla Lyman.
Ophiacantha fraterna Verrill.
Ophiacantha granulifera Verrill.
Ophiacantha lineata Kœhler.
Ophiacantha pentactinus Lütken.
Ophiacantha meridionalis Lyman.
Ophiacantha vcratica Lyman.

Ophiacantha vivipara Ljungman.
Ophiacantha (Ophiopristis) permixta, new species.
Ophiacantha (Ophiotreta) affinis, new species.
Ophiacantha (Ophiotreta) sertata (Lyman).
Ophiacantha (Ophiotreta) valenciennesi Lyman.
Ophiomitrella americana, new species.
Ophiomitrella levis, new species.
Ophiomitrella laxipellis (Lyman).
Ophiomitrella porrecta, new species.
Ophiomittra robusta, new species.
Ophiomittra valida Lyman.
Ophiopora bartlettii (Lyman).

Ophiolima littoralis Kœhler.
Ophiolella minima Kœhler.
Ophiotrema gracilis, new species.
Ophiocamax austera Verrill.

Ophiocamax fasciculata Lyman.
Ophiologmus secundus, new species.
Ophiochiton grandis Verrill.

Family OPHIOCOMIDÆ.

Ophiocoma alexandri Lyman.
Ophiocoma echinata (Lamarck).

Ophiocoma pumila Lütken.
Ophiocoma riisei Lütken.

Family OPHIOTHRICIDÆ.

Ophiothrix angulata (Say).
Ophiothrix lineata Lyman.
Ophiothrix arstedii Lütken.

Ophiothrix suensonii Lütken.
Ophiothrix convoluta, new species.

Family OPHIOSCOLECIDÆ.

Ophioscolex glacialis Müller and Troschel.
Ophioleptoplax atlantica, new species.

Ophiobyrseella quadrispinosa, new species.

Family OPHIOCHONDRIDÆ.

Ophiochondrus granulatus, new species.

Ophiochondrus armatus (Kœhler).

Family OPHIOMYXIDÆ.

Ophiomyxa flaccida (Say).

Ophiodera stimpsonii (Lyman).

Family HEMIEURYALIDÆ.

Sigsbeia conifera, new species.

Sigsbeia serradiata, new species.

Family ASTROCHEMIDÆ.

Astrochema elongatum, new species.

DESCRIPTIONS OF GENERA AND SPECIES.

Family OPHIODERMATIDÆ.

OPHIODERMA APPRESSA (Say).

(=*Ophioderma virescens* Lütken.)

See for bibliography:

Lyman (82),¹ p. 9.
 Verrill (99), p. 6.
 H. L. Clark (01), p. 242.
 H. L. Clark (01a), p. 340.
 Verrill (07), p. 326.
 Kœhler (07), p. 280.
 Kœhler (13), p. 353.

Albatross station 2323. Jan. 17, 1885. Lat. 23° 10' 51'' N.; long. 82° 19' 03'' W.; 163 fathoms; wh. br. co. One specimen.

Albatross station 2337. Jan. 19, 1885. Lat. 23° 10' 39'' N.; long. 82° 20' 21'' W.; 199 fathoms; co. One specimen.

Fish Hawk station 7182. Nov. 28, 1901. Lat. 29°; long. 83° 18' 45'' W.; 5½ fathoms; rocky coral; temp. 15.3° C. Three specimens.

Fish Hawk station 7215. Jan. 15, 1902. Lat. 28° 26' N.; long. 83° 02' 30'' W.; 7½ fathoms; rocky coral; temp. 13° C. One specimen.

¹ The figures in parentheses, printed in boldface type, refer to the bibliographic index at the end of the paper.

*Fish Hawk*¹ station 7253. Jan. 28, 1902. Highland. Lat. 27° 55' 30'' N.; long. 83° 11' 30'' W.; 13 fathoms; c. r.²; temp. 15.2° C. Two specimens.

Fish Hawk station 7281. Jan. 23, 1902. Anclote. Lat. 28° 03' 30'' N.; long. 83° 10' W.; 10 fathoms; s.; temp. 52° F. Two specimens.

Sand Key Reef, Florida. Four specimens.

Garden Key, Florida. One dry specimen.

Tortugas Reef, Florida. One dry specimen.

Florida. One dry specimen.

Abaco, Bahamas. Eleven specimens.

Hungry Bay, Bermudas. Three specimens.

Key West. Three specimens.

Swan Islands. Three specimens.

Ascension Island. One specimen.

OPHIODERMA EREVICAUDA Lütken.

See for bibliography:

Lütken (59), p. 94, pl. 1, fig. 3.

Lyman (65), p. 16.

Lyman (82), p. 9.

Verrill (99), p. 5.

Kæhler (07), p. 281.

Kæhler (13), p. 354.

Albatross station 2604. Oct. 18, 1885. Lat. 34° 37' 30'' N.; long. 75° 39' 45'' W.; 34 fathoms; yl. s. brk. sh. One specimen.

Albatross station 2608. Oct. 19, 1885. Lat. 34° 32' 00'' N.; long. 76° 12' 00'' W.; 22 fathoms; crs. gy. s. bk. sp. Two specimens.

Fish Hawk station 7164. Nov. 21, 1901. Pepperfish Key. Lat. 83° 37' 20'' N.; long. 29° 10' 45'' W.; 8½ fathoms; s.; temp. 18° C. One specimen.

Abaco, Bahamas. Some specimens.

Key West. One specimen.

Ascension Island. One specimen.

The specimens from Abaco are rather large, but they have almost completely lost their color, as have those from stations 2604 and 7164 and that from Ascension. The two smaller specimens from station 2608 have partly preserved their greenish tint.

OPHIODERMA BREVISPIÑA (Say).

(=*Ophiura olivaceum* Ayres and *O. serpens* Lütken.)

See for bibliography:

Lyman (82), p. 9.

Verrill (99), p. 4.

H. L. Clark (01), p. 241.

Kæhler (07), p. 281.

Verrill (07), p. 326.

Kæhler (13), p. 354.

¹ The steamers *Fish Hawk*, *Albatross*, and *Speedwell* and the schooner *Grampus* are vessels of the United States Fish Commission now known as the United States Bureau of Fisheries.

² The abbreviations for bottom materials are those used by the Bureau of Fisheries in its published records of dredging and other stations.

Albatross station 2467. July 3, 1885. Lat. $45^{\circ} 23' N.$; long. $55^{\circ} 41' W.$; 38 fathoms; fnc. wh. s. bk. sp.; temp. $35.8^{\circ} F.$ Two specimens.

Fish Hawk station 7181. Nov. 28, 1901. Lat. $29^{\circ} 2' 30'' N.$; long. $83^{\circ} 14' W.$; $4\frac{1}{2}$ fathoms; sdy.; temp. $14.8^{\circ} C.$ One specimen.

Fish Hawk station 7221. Jan. 15, 1902. Lat. $28^{\circ} 34' 45'' N.$; long. $83^{\circ} 08' W.$; $5\frac{1}{2}$ fathoms; c. r. grs.; temp. $12.5^{\circ} C.$ One specimen.

Fish Hawk station 7223. Jan. 17, 1902. Lat. $28^{\circ} 36' N.$; long. $82^{\circ} 57' W.$; 3 fathoms; sdy. grsy.; temp. $11.6^{\circ} C.$ One specimen.

Fish Hawk station 7225. Jan. 17, 1902. Lat. $28^{\circ} 42' 30'' N.$; long. $83^{\circ} 09' 45'' W.$; 7 fathoms; s. brk. sh. grs.; temp. $12.2^{\circ} C.$ One specimen.

Fish Hawk station 7277. Feb. 13, 1902. Key West. $5\frac{1}{2}$ fathoms; co. s. grs.; temp. $20^{\circ} C.$ Two specimens.

Fish Hawk station 7354. Dec. 17, 1902. Florida Bay. Lat. $25^{\circ} 10' 10'' N.$; long. $81^{\circ} 28' 30'' W.$; $4\frac{1}{2}$ fathoms; h. gy. s.; temp. $23.5^{\circ} C.$ Two specimens.

Fish Hawk station 7373. Dec. 19, 1902. Florida Bay. Lat. $25^{\circ} 01' N.$; long. $81^{\circ} 25' 30'' W.$; $4\frac{1}{2}$ fathoms; sp. s. sh.; temp. $23^{\circ} C.$ Three specimens.

Fish Hawk station 7426. Jan. 27, 1903. Hawk Channel; 18 feet; s. and grs.; temp. $23.5^{\circ} C.$ One specimen.

Fish Hawk station 7429. Jan. 27, 1903. Hawk Channel; 14 feet; rky. Four specimens.

Fish Hawk station 7466. Feb. 19, 1903. Hawk Channel; $2\frac{1}{2}$ fathoms. Barry.

Fish Hawk station 7467. Feb. 19, 1903. Hawk Channel; $2\frac{1}{2}$ fathoms. Two specimens.

Fish Hawk station 7484. Mar. 7, 1903. Biscayne Bay Key, Florida; $1\frac{1}{2}$ fathoms; s. grs. Two specimens.

Grampus station 5108. Mar. 21, 1889. Lat. $26^{\circ} 19' N.$; long. $83^{\circ} 11' W.$; 27 fathoms; m. Three specimens.

Florida:

Key West. Forty-eight specimens.

Key Largo. Forty-eight specimens.

Indian Key. Seven specimens.

Lower Matacumba. Two hundred and twelve specimens.

Cape Romano. One specimen.

Cedar Keys. Sixty-nine specimens.

Boca Ceiga Bay. Three specimens.

Sarasota Bay. Four specimens.

Puntarasa. A few specimens.

St. Augustine. One dry specimen.

Dry Tortugas. Three specimens.

NW. end St. Martin's reef. One specimen.

No label. Three specimens.

O. brevispina offers a wide geographical range, and the synonymy with *O. olivacea* being admitted, the species would extend from Cape Cod and Vineyard Sound to the Brazilian coasts, where it has been reported by Ludwig. Verrill is rather inclined to see in the form *olivacea*, which had formerly been described as a distinct species, a northern variety living between Cape Cod and Charleston.

I do not think that this species can be united with *O. januarii* Lütken. I have been able to compare with the numerous specimens of *O. brevispina* which I have been studying of late years, one of Lütken's two types which are preserved in the Copenhagen Museum and which were most kindly lent to me by Doctor Mortensen. It is undoubtedly quite a distinct form; besides the fact that *O. januarii* always reaches a very large size (the diameter of the disk is 18 mm. in Lütken's types and 17 mm. in Lyman's example), I notice that the characters indicated by Lütken are very obvious, and the notches of the upper face of the disk at the beginning of the arms are even still deeper than indicated on Lütken's drawing; the spines, which are cylindrical, are almost as long as the article. To sum up, the differences are important enough to justify the separation of the two species, between which I have never observed any intermediate form.

OPHIODERMA CINEREA Müller and Troschel.

(=*Ophioderma antillarum* Lütken.)

See for bibliography:

- Verrill (99), p. 6.
H. L. Clark (01), p. 242.
Verrill (07), p. 325.
Köhler (07), p. 281.
Köhler (13), p. 354.

- Albatross* station 2160. Apr. 30, 1884. Lat. 23° 10' 31'' N.; long. 82° 20' 37'' W.; 167 fathoms; co. One specimen.
Albatross station 2166. May 1, 1884. Lat. 23° 10' 36'' N.; long. 82° 20' 30'' W.; 196 fathoms; co.; temp. 71.9° F. Five specimens.
Albatross station 2326. Jan. 17, 1885. Lat. 23° 11' 45'' N.; long. 82° 18' 54'' W.; 194 fathoms; br. co.; temp. 62° F. One specimen.
Albatross station 2330. Jan. 17, 1885. Lat. 23° 10' 48'' N.; long. 82° 19' 15'' W.; 121 fathoms; fine. gy. co. Four specimens.
Albatross station 2333. Jan. 19, 1885. Lat. 23° 10' 36'' N.; long. 82° 19' 12'' W.; 169 fathoms; fine. wh. co. Two specimens.
Albatross station 2334. Jan. 19, 1885. Lat. 23° 10' 42'' N.; long. 82° 18' 24'' W.; 67 fathoms; wh. co. Four specimens.
Albatross station 2336. Jan. 19, 1885. Lat. 23° 10' 48'' N.; long. 82° 18' 52'' W.; 157 fathoms; co. Two specimens.
Albatross station 2341. Jan. 19, 1885. Lat. 23° 11' 00'' N.; long. 82° 19' 06'' W.; 143 fathoms; co. One specimen.
Albatross station 2384. Mar. 3, 1885. Lat. 28° 45' 00'' N.; long. 88° 15' 30'' W.; 940 fathoms; br. gy. m.; temp. 39.6° F. Eight specimens.
Fish Hawk station 7231. Jan. 23, 1902. Anclote. Lat. 28° 03' 30'' N.; long. 83° 10' W.; 10 fathoms; rky. c.; temp. 13.5° C. Three specimens.
Key West, Florida. Three specimens.
New Providence, Bahamas. Three specimens.
Port Castries, St. Lucia. One specimen.
Abrolhos Islands, Brazil. *Albatross*, Dec. 27, 1887. Nine dry specimens, very large and fine. The diameter of the disk ranges between 20 and 26 mm.

OPHIODERMA RUBICUNDA Lütken.

See for bibliography:

- Verrill (96), p. 6.
H. L. Clark (91), p. 242.
Köhler (97), p. 282.
Köhler (13), p. 354.

Nassau. One specimen (No. 14646).

OPHIODERMA VARIEGATA Lütken.

- Ophioderma variegata* LÜTKEN (59), p. 97.
Ophioderma variegata LJUNGMAN (66), p. 304.
Ophiura variegata VERRILL (67), p. 254.
Ophiura variegata LYMAN (75), p. 3.
Ophiura variegata LYMAN (82), p. 10.
Ophioderma variegata LÜTKEN and MORTENSEN (99), p. 100.
Ophioderma variegata KÖHLER (97), p. 282.

Albatross station 2824. Apr. 30, 1888. Gulf of California. Lat. 24° 22' 30" N.; long. 110° 19' 30" W.; 8 fathoms; brk. sh. Ten specimens.

The diameter of the disk ranges between 5 and 8 mm.; the length of the arms reaches 25 mm.

Most of the specimens have preserved bright colors. The upper face of the disk is pink or even red, washed with green in the interradial spaces near the margin of the disk; the under face is greenish. The arms are annulated with green and red. These colors are even brighter than is generally indicated.

By their general structure, these specimens are most closely allied with *O. brevispina* from the Atlantic, from which they differ above all by their coloration. The brachial spines, generally amounting to seven, are short. *O. variegata* is likely to be one day definitely classified with *O. brevispina*, as some writers have already suggested.

OPHIODERMA CLYPEATA, new species.

Plate 18, figs. 2 and 6.

Blake station, 241. Feb. 24, 1879. Off Grenadines; 163 fathoms; s., co.; temp. 53° F. One specimen.

Type.—Cat. No. 6514, U.S.N.M.

This *Ophiura* was labeled *Ophioderma elaps*? It was mentioned under the same name, followed as well by a note of interrogation, by Lyman in 1883 (83, p. 230), with other individuals coming from two other stations (depths 300 and 120 fathoms), and which I have not seen.

Lyman says only that these specimens differ from Lütken's type in having from six to seven brachial spines instead of from seven to eight. In fact, the differences are actually more important, and I have been able to appreciate them by comparing the specimen which belongs to the United States National Museum with one of Lütken's types, which my friend Doctor Mortensen has kindly lent me. It seems to me impossible that this specimen should be united with *O. elaps*, and, in my opinion, it ought to constitute a new species for which I propose the name of *Ophioderma clypeata*.

I give here (pl. 18, figs. 2 and 6) two photographs representing the upper and under faces of the new species, and, for comparison, a photograph of the under face of *O. claps* (fig. 4); the upper face of the disk and a side view of the arms of the latter species are represented on plate 1, figs. 1 and 2.

The new species being fairly near to *O. claps*, it will be sufficient to indicate here the differences which separate them.

The diameter of the disk is 29 mm. and the largest arm is 142 mm. long.

The notches of the upper face of the disk of *O. clypeata*, at the beginning of the arms, are less strongly marked than in *O. claps*; they do not reach beyond the second upper brachial plate, and, moreover, the first of these two plates is extremely short and rudimental; it may even be completely lacking; while in *O. claps*, the notch extends at least as far as the middle of the third upper brachial plate. The shape of the upper brachial plates is the same in both species, but the under plates of *O. clypeata* are very much widened, and they are much wider than long, with a convex distal edge and rounded sides, while in *O. claps*, these plates are almost square, nearly as wide as long, and the lateral edges remain straight; they join the distal side by a rounded angle only.

The number of the brachial spines is always inferior by one unit to that observed in *O. claps* as it has been indicated by Lyman. This number, which is seven at the base of the arms, afterwards decreases to six. Excepting the first ventral spine, which is more developed, all these spines are almost as long as the article and they are clearly more elongated than in *O. claps*; consequently, the difference between the length of the first ventral spine and that of the following spines is not so strongly marked as in the latter species; in return, this first ventral spine is a little more widened here.

Lastly, the shape of the mouth shields is altogether different in the two species. Instead of being triangular, as long as wide, with a rounded apex, a convex distal edge and very widely rounded lateral angles, these shields are rather quadrangular: they are somewhat longer than wide and their distal side, which is very clearly excavated, joins the lateral edges in angles which are more open and much more broadly rounded than in *O. claps*. These lateral edges are hardly convergent and they are united by a very convex proximal edge, but they do not join in an angle, as is the case for this latter species. The shield which carries the madreporic pore is more particularly elongated and it is one-and-a-half times longer than wide.

The sum of these characters seems important enough to account for a specific separation for this *Ophioderma*, which perhaps does not abandon a certain depth.

OPHIODERMA, species ?, young.

Plate 2, figs. 1-2.

Green Cay, Bahamas. One specimen (Acc. No. 41471).

I can not specifically determine a very young specimen which evidently belongs to the genus *Ophioderma*, the diameter of the disk of which does not exceed 4.5 mm., while its arms reach only 10 mm. This example is remarkable, owing to the fact that the various parts of the body are almost entirely covered with very numerous granules which appear on certain plates or plate-parts which ought to be bare in

the adult. Thus the central part of the upper and under brachial plates alone is visible, and the bare parts of these plates remain separated from one another by several rows of granules. These completely cover the lateral plates and the mouth pieces, which in consequence entirely disappear. On the upper face of the disk, however, the radial shields are distinct and completely bare. The brachial spines amount to six only: They are short, small, conical, pointed, rather loosely set together, and the first ventral one is a little larger than the others. The two successive genital slits, which normally exist in the genus *Ophioderma* on each side of the interradial spaces at the base of the arms, are already well shaped and well separated.

This specimen must be a young one of a rather large-sized species, perhaps of *O. cinerea*. Owing to its peculiar characters, I beg to present here two illustrations which represent respectively its upper and its under face (pl. 2, figs. 1, 2).

OPHIARACHNELLA (=PECTINURA) ANGULATA (Lyman).

Pectinura angulata LYMAN (83), p. 232, pl. 3, figs. 7-9.

Pectinura angulata VERRILL (99), p. 8.

Ophiarachnella angulata H. L. CLARK (09), p. 124.

Albatross station 2350. Jan. 20, 1885. Lat. $23^{\circ} 10' 39''$ N.; long. $80^{\circ} 20' 21''$ W.; 213 fathoms; co. One specimen.

The example is in good state, although one of the arms has been broken from its base; the diameter of the disk is 25 mm., and the length of the arms exceeds 120 mm. It is altogether in conformity with Lyman's description: There are three pairs of pores at the beginning of the arms and the tentacular scales are really two. It was owing to a misprint, which H. L. Clark pointed out with reason, that I indicated a single tentacular scale when comparing this species with *Pectinura honorata* (04, p. 8).

The Blake dredged *O. angulata* between 88 and 248 fathoms, and the Bahama expedition found it again on the Bahama Bank.

BATHYPECTINURA TESSELLATA (Lyman).

See for bibliography:

H. L. Clark (09), p. 130.

Albatross station 2384. Mar. 3, 1885. Lat. $28^{\circ} 45' N.$; long. $88^{\circ} 15' 30'' W.$; 940 fathoms; br. gy. m.; temp. $39.6^{\circ} F.$ One specimen.

Family OPHIOLEPIDÆ.

OPHIOLEPIS ELEGANS Lütken.

Ophiolepis elegans LÜTKEN (59), p. 105.

Ophiolepis elegans LYMAN (65), p. 58, pl. 2, fig. 5.

Ophiolepis elegans LYMAN (82), p. 20.

Ophiolepis elegans IVES (89), p. 175.

Ophiolepis elegans H. L. CLARK (01), p. 242.

Albatross station 2605. Oct. 18, 1885. Lat. $34^{\circ} 35' 30'' N.$; long. $75^{\circ} 45' 30'' W.$; 32 fathoms; wh. s. bk. sp. One specimen.

Albatross station 2608. Oct. 19, 1885. Lat. $34^{\circ} 32' N.$; long. $76^{\circ} 12' W.$; 22 fathoms; crs. gy. s. bk. sp. Three specimens.

Grampus station 5076. Mar. 1, 1889. Lat. $25^{\circ} 24' N.$; long. $83^{\circ} 28' W.$; 39 fathoms; gr. co. fne. sh. One specimen.

Grampus station 5088. Mar. 11, 1889. Lat. $25^{\circ} 44' 32'' N.$; long. $83^{\circ} 24' 15'' W.$; 34 fathoms; fne. s. Two specimens.

Grampus station 5100. Mar. 18, 1889. Lat. $26^{\circ} 04' N.$; long. $83^{\circ} 00' W.$; 26 fathoms; hrd. blk. gr. One specimen.

Grampus station 5102. Mar. 18, 1889. Lat. $26^{\circ} 08' N.$; long. $83^{\circ} 22' W.$; 33 fathoms; s. blk. sp. One specimen.

Grampus station 5109. Mar. 21, 1889. Lat. $26^{\circ} 17' 30'' N.$; long. $83^{\circ} 00' W.$; 24 fathoms; fne. gy. s. blk. sp. One specimen.

Fish Hawk station 7108. Mar. 28, 1901. N. Channel into Tampa Bay; $12\frac{3}{4}$ fathoms; br. sh. and s.; temp. $19.1^{\circ} C.$ Ten specimens.

Fish Hawk station 7180. Nov. 27, 1901. North Key; $3\frac{1}{4}$ fathoms; sdy. rky.; temp. $14.5^{\circ} C.$ One specimen.

Fish Hawk station 7210. Dec. 9, 1901. Lat. $28^{\circ} 50' 30'' N.$; long. $83^{\circ} 11' 45'' W.$; 6 fathoms; sdy. stcky.; temp. $16.5^{\circ} C.$ One specimen.

Fish Hawk station 7261. Jan. 29, 1902. Highland. Lat. $27^{\circ} 42' 30'' N.$; long. $82^{\circ} 46' 50'' W.$; $3\frac{1}{4}$ fathoms; hrd. brk. sh.; temp. $15.5^{\circ} C.$ Four specimens.

Fish Hawk station 7290. Feb. 24, 1902. Lat. $24^{\circ} 46' 12'' N.$; long. $81^{\circ} 53' 30'' W.$; $10\frac{1}{2}$ fathoms; co.; temp. $19^{\circ} C.$ Two specimens.

Fish Hawk station 7291. Feb. 24, 1902. Lat. $24^{\circ} 42' 30'' N.$; long. $81^{\circ} 55' 52'' W.$; $7\frac{1}{4}$ fathoms; hd. smooth; temp. $19.5^{\circ} C.$ One specimen.

Fish Hawk station 7349. Dec. 17, 1902. Florida Bay; $11\frac{1}{2}$ feet; s. sh. Twenty-six specimens.

Fish Hawk station 7516. Mar. 30, 1903. Gulf Stream off Cape Florida; fn. gy. s. co.; temp. $69^{\circ} F.$ One specimen.

Fish Hawk station 7517. Mar. 30, 1903. Gulf Stream off Cape Florida. Thirty-six fathoms; fn. gy. s. brk. sh.; temp. $74^{\circ} F.$ Five specimens.

Nassau. *Albatross*. One specimen.

Sarasota Bay, Florida. Eleven specimens.

Puntarasa, Florida. Many specimens.

Charlotte Harbor, Florida. Three specimens.

N. W. end of St. Martin's Reef, Florida. Four specimens.

Tampa Bay, Florida. Several specimens.

Marco, Florida. Many specimens.

Cape Romano, Florida. Thirteen specimens.

South of Key West, Florida. One specimen.

Florida. Five specimens.

Charleston Harbor, South Carolina. One specimen.

O. elegans has been found previously in South Carolina and various localities of the West Indies. Greeff met with it on the western coast of Africa.

OPHIOLEPIS PAUCISPINA (Say).

See for bibliography:

- Lütken (59), p. 102, pl. 2, fig. 2.
Lyman (65), p. 55.
Lyman (82), p. 19.
Greeff (82), p. 157.
Kehler (07), p. 287.
Verrill (07), p. 325.
Kehler (13), p. 355.

Key West, Florida. Four specimens.

Without indication. One specimen.

This species, known in several parts of the West Indies, has been found by Greeff at San Thomé (Guinea), at a depth of 15-20 fathoms.

OPHIOZONA IMPRESSA (Lütken).

See for bibliography:

- Verrill (99), p. 8.
H. L. Clark (01), p. 243.
Kehler (13), p. 355.

Dry Tortugas, Florida. One specimen.

Key West, Florida. Forty specimens.

OPHIOZONA NIVEA var. COMPTA Verrill.

Ophiozona nivea var. *compta* VERRILL (99a), p. 303.

Off Havana, 1886. One specimen.

Diameter of disk 9.5 mm.; one arm only is entire, its length being about 30 mm. The radial shields are separated on their whole length.

This specimen can be referred to the variety distinguished by Verrill, but if we consider how easily this species varies, a fact owned by Verrill himself, one may be in doubt as to the usefulness of introducing a new variety based on the radial shields being more or less spread, while there are other plates, such as the mouth shields for instance, which are likely to vary quite notably in shape and in their relations with one another.

O. nivea var. *compta* has been met with off Havana, between 110 and 263 fathoms. The typical species has been taken in various localities of the Caribbean Sea by the Hassler and the Blake, between 56 and 424 fathoms.

OPHIOMASTUS SECUNDUS Lyman.

- Ophiomastus secundus* LYMAN (78a), p. 218, pl. 2, figs. 16-18.
Ophiomastus secundus LYMAN (82), p. 101, pl. 39, fig. 14.
Ophiomastus secundus LYMAN (83), p. 248.

Albatross station 2645. Apr. 9, 1886. Lat. 25° 46' 30'' N.; long. 80° 02' W.; 157 fathoms; gn. s.; temp. 43.4° F. Several specimens.

Albatross station 2646. Apr. 9, 1886. Lat. 25° 47' N.; long. 80° 05' W.; 85 fathoms; gy. s. for. Three specimens.

Albatross station 2666. May 5, 1886. Lat. $30^{\circ} 47' 30''$ N.; long. $79^{\circ} 49'$ W.; 270 fathoms; gy. s.; temp. 48.3° F. Two specimens.

Fish Hawk station 7295. Feb. 26, 1902. Lat. $24^{\circ} 21' 45''$ N.; long. $81^{\circ} 47' 45''$ W.; 122 fathoms; co.; temp. 19.5° C. One specimen.

O. secundus has been found by the *Blake* at Santa Cruz and various other places in the West Indies, between 60–150 and 1,131 fathoms.

OPHIOGLYPHA CONVEXA Lyman.

Plate 2, figs. 5–6.

See for bibliography:

Köehler (09), p. 149.

Albatross station 2097. Oct. 1, 1883. Lat. $37^{\circ} 56' 20''$ N.; long. $70^{\circ} 57' 30''$ W.; 1,917 fathoms; glob. oz. Six specimens.

Albatross station 2098. Oct. 1, 1883. Lat. $37^{\circ} 40' 30''$ N.; long. $70^{\circ} 37' 30''$ W.; 2,221 fathoms; glob. oz. Seventeen specimens.

The diameter of the disk ranges between 10 and 15 mm.

I have already referred¹ to the variations which this species may offer and which I myself have ascertained after Lyman. When the upper plates of the disk become more numerous, the specimens may display some characters which recall those of *O. bullata* Wyville-Thomson and, in this connection, I must particularly refer to two specimens from station 2098. In one of them, the diameter of the disk of which reaches only 12 mm., the upper plates are not so numerous as usual, but the six primary plates are separated from one another in each interrational space by two successive little plates, an arrangement which has not yet been reported in *O. convexa*; the two radial shields of each pair are also isolated from each other by a row of small plates. In the other specimen, the diameter of the disk of which is 15 mm., the radial shields are also separated on their whole length and the upper plates of the disk are fairly numerous. This arrangement, in such specimens as undoubtedly belong to *O. convexa*, makes a transition to *O. bullata* to which, in other respects, *O. convexa* is closely allied.

But whatever may be the variations in the arrangement of the upper plates of the disk, the radial comb always consists of low, short, and rectangular papillæ, as I have indicated in my paper on the Echinoderms of the *Princesse-Alice* (09, pl. 25, figs. 1 and 2). Besides, I shall refer again to the characters of *O. convexa* when studying the following species, which is very closely allied to it.

OPHIOGLYPHA CORONATA, new species.

Plate 2, figs. 3–4.

? *Ophioglypha convexa* LYMAN (83), p. 247.

Albatross station 2750. Nov. 27, 1887. Lat. $13^{\circ} 30'$ N.; long. $63^{\circ} 31'$ W.; 496 fathoms; glob. oz.; temp. 36.8° F. Two specimens.

Type.—Cat. No. 32290, U.S.N.M.

The diameter of the disk is respectively 10.5, and 12 mm.; one of the arms, apparently entire, of the larger specimen, measures 25 mm.

¹ Échinodermes provenant des campagnes du yacht *Princess Alice*, 1909, p. 150.

There is no doubt that this species, which I must consider as a new one, is identical with the *Ophioglypha* indicated by Lyman¹ in 1883, who referred it, together with other specimens, to *O. convexa*, and which came from the dredgings of the *Blake* in the West Indies. Here is what Lyman wrote about these specimens:

The six primary plates extremely swollen, form an elevated rosette, overhanging very small radial shields, not so large as the head of the genital scale. The mouth shield, too, occupies the *whole* of the lower interbrachial space. But specimens from station 148 were intermediate, or rather differed from the typical form only in finer arm comb papillæ and more interbrachial scales on the disk margin. It will be necessary to await further dredgings before deciding the specific limits. It is to be noted as an important difference, that, while the typical *O. convexa* is found in 2,350 fathoms, this species does not go below 240 fathoms.

I find again, in the collection of the Ophiurans of the *Albatross*, two specimens which offer precisely the same peculiarities as Lyman indicated in 1883; it seems to me obvious that these two examples can not be referred to *O. convexa*, but that they must constitute a different species the characters of which it is necessary to describe. The disk is pentagonal and even slightly excavated in the interradian spaces; it is thick, but the upper face is little convex; the under face is plane. The arms, rather short, grow rapidly thinner from the base which, besides, is not very wide.

The upper face of the disk is mostly occupied by six large polygonal plates, contiguous and subequal, arranged as in *O. convexa*, but the part of the disk covered by them is still larger than in the latter species. Out of this primary rosette there is to be seen, in each interradian space, but one single large plate, pentagonal, somewhat longer than wide, with a proximal angle widely opened and a distal side lying very close to the outline of the disk; in fact, out of that plate is seen only one other plate which is extremely short and transversally widened. On each side of the large interradian plate, and in its distal region, there are two or three extremely small plates continued on the sides of the marginal plate which succeeds the above-mentioned interradian plate. The radial spaces are entirely occupied by the two radial shields which are in contact with the corresponding primary radial plate, but are much smaller than the latter.

These shields are a little wider than long; the two in each pair are contiguous on their whole length and they form distally an extremely obtuse angle into which is inserted the corresponding angle of the first upper brachial plate. All the plates of the upper face of the disk are covered with pretty fine, rounded granules, which shoot from the angles of a polygonal netting which covers the plates and separates small rounded facets. The radial papillæ, visible on the upper face, are extremely elongated and closely disposed, numerous, fine, and sharp; they become rapidly shorter on the under face, and do not extend beyond the level of the distal third of the mouth shield.

The under face of the disk, in the interradian spaces, is not very wide owing to the widening of the arms at their bases; it is not completely covered by the mouth shields, out of which is left a small space covered by a few polygonal and unequal plates, among which one may be seen occupying a more or less exactly median place, which is a little larger than the others. The genital plates are fairly

¹ Bull. Mus. Comp. Zool., vol. 10, p. 243.

wide, but they do not extend much beyond the distal margin of the mouth shields. The genital slits are narrow, but quite distinct, and they are continued nearly up to the end of the mouth shields, on the same level as the middle of the first lateral brachial plate.

The mouth shields are large, elongated, but their width is not very important; they are almost pyriform and much more widened distally than proximally; they are almost twice longer than wide. They offer a very obtuse and short proximal angle, and then, a little further back, they are somewhat notched by the extremity of the genital slit; beyond that, they first grow rapidly wider, and then more slowly so, up to their distal part which is limited by a strongly rounded border. The adoral plates are fairly wide with their two margins almost parallel, but narrower without than within; they are one and a half longer than wide. The oral plates are pretty high. The oral papillæ amount to six at least on each side, but the four or five external papillæ, very low and rectangular, are more or less jointed and their outlines are hardly apparent; the innermost papilla is conical and pointed, and it is smaller than the odd terminal papilla, which is also conical and pointed. All these mouth plates, as well as those of the under face of the disk, are covered with fine rounded granulations.

The arms, fairly broad at their bases, grow rapidly thinner; they are hardly carinated and their upper face is convex. Only the first upper brachial plate is large, triangular, with a very obtuse proximal angle and a very convex distal margin. The second one, of hexagonal shape, is extremely wide and at least twice wider than long, with a concave proximal margin, and a very convex distal margin, while the lateral margins are each resolved into two little sides meeting in an obtuse angle. The third and fourth plates are still hexagonal, but their width rapidly decreases at the same time as the proximal side becomes narrower, so that they assume a triangular shape, with a proximal angle which is truncated on the fifth and sixth plates, but their distal margin may generally be divided into two distinct sides which meet in an obtuse angle; these plates remain wider than long and they part, from the sixth or seventh, upward. Beyond that the plates become triangular, a little wider than long, with very sharp angles and a feebly convex distal margin. The first plates are granulous, like those of the upper face of the disk, but the granules very soon disappear and the surface of the former becomes almost smooth, contrary to what happens with the neighboring lateral plates which always remain more or less strongly granulated.

The under brachial plates are rather small and a great part of the under face of the arms is covered by the lateral plates. The first four or five under brachial plates are separated from one another by a narrow and shallow transverse furrow. The first under plate is large, triangular, with the proximal angle truncated and the three sides somewhat excavated. The second one, trapezoidal, is as wide as the first one, but it is wider than long, with the distal side longer than the proximal one, which is excavated. The third plate is trapezoidal also and wider than long, but narrower than the preceding one. The fourth plate, still trapezoidal, is a little longer than wide and its distal margin is almost straight. The fifth and sixth plates are also a little longer than wide, but they become narrower than the fourth and their proximal margin is apt to be elongated into a slightly obtuse angle.

Beyond that the plates, which up to that point were separated only by the transverse furrow which I have mentioned above, go farther and farther apart from each other; they become at first pentagonal [and as long as wide, and soon assume a triangular shape with a very convex distal margin, and at the same time become wider than long. It must be noticed that the first under plates have granules just like the other plates of the body, but about the eighth plate these granules begin to be arranged in regular transverse sets which will form pretty well marked striae on the surface of the next plates. A like structure appears only to a very small extent, or is even completely lacking, on the lateral plates.

The lateral plates are broadly developed and take up an important part of the upper and under faces of the arms; their surfaces are covered with granules, which disappear only at the extremities of the arms. On their distal margin there are generally three short, papilliform, and sharp spines, the dorsal spine being a little isolated from the other two. On some articles of one of the arms I exceptionally find four spines which are separated by equal intervals.

The tentacular pores of the first pair open widely in the mouth, and they generally carry five scales on each margin; these scales are small, truncated, very closely put together or even somewhat jointed. The pores of the second pair have four or five scales on the proximal or external margin and four on the opposite margin, the latter being less developed than the proximal ones. A like arrangement is observed on the pores of the third and of the fourth pair. On the pores of the fifth and sixth pairs the proximal margin carries four scales and the distal margin has but two small ones. On the following pores these distal scales rapidly disappear, but of the proximal scales there remain three, a number which is persistently found on almost the whole length of the arms; but the scales become smaller, short, and conical.

The color of the specimens in alcohol is grayish-white.

Resemblances and differences.—*O. coronata* is evidently closely allied to *O. convexa*, although distinct from it. I think the two should be separated. We have seen that Lyman had already attempted to do so. The six primary plates are largely developed, and they take up on the upper face of the disk a comparatively larger space than in *O. convexa*, so as to leave room for only a single interradial plate, a very large one, larger even than in *O. convexa*. The radial shields are relatively small and more reduced than in the latter species. The radial papillae are extremely narrow, cylindrical, elongated, pointed, numerous, and closely put together, and they completely differ from those which are known to exist in *O. convexa*, these latter being rather low and rectangular, as I indicated in 1909 (09, p. 149).

The arms are far less carinated than in *O. convexa*. The upper brachial plates are quadrangular on the first articles only and rapidly become triangular, while in *O. convexa* they remain quadrangular on more than half of the length of the arms, and become triangular only beyond that point, although they remain as long as wide or even a little longer than wide. On the under face the arms are more widened at their base, consequently the interradial spaces are narrower than in *O. convexa* and the mouth shields themselves are also narrower. Lyman had observed that in some specimens of the *Blake* these shields covered the whole under face of the disk inwardly of the genital plates; such is not the case in my two examples, which

show out of the mouth shields a few small distal plates. The under brachial plates are less developed in the new species and they become a little longer than wide only between the fourth and the seventh article or thereabout, after which they rapidly become very small and triangular; I notice, on the contrary, that in *O. convexa* these plates remain longer than wide on the longest part of the arms, and they do not assume a triangular shape until near the last articles. All these differences may readily be understood from the photographs which I reproduce here (pl. 2, figs. 3-6). It will be seen that a specific separation is amply justified.

Let it be added, also, as Lyman stated, that *O. convexa* has always been caught in great depths, while the specimens of the *Blake* came from depths ranging between 114 and 270 fathoms; the two specimens of the *Albatross* were found somewhat deeper.

One might also compare *O. coronata* with *O. solida* Lyman, in which the plates of the upper face of the disk are arranged in a similar manner, but the characters of the under face, and among others the shape of the mouth shields, which are very small, as well as that of the under brachial plates, make any comparison impossible.

OPHIOGLYPHA ELEVATA Lyman.

Plate 3, fig. 5.

Ophioglypha elevata LYMAN (78), p. 82, pl. 4, figs. 87-89.

Ophioglypha elevata LYMAN (82), p. 57, pl. 5, figs. 16-18.

Albatross station 2675. Lat. $32^{\circ} 32' 30''$ N.; long. $77^{\circ} 15'$ W.; 327 fathoms; gy. s. bk. sp. sh.; temp. 45.8° F. One specimen.

The diameter of the disk is 7 mm.; none of the arms is preserved to its entire length.

Lyman's type was found by the *Challenger* in lat. $46^{\circ} 40'$ S. and long $37^{\circ} 50'$ E., in a depth of 310 fathoms. Notwithstanding the long distance between the stations, the example found by the *Albatross* really belongs to Lyman's species, although I notice a few differences which are rather unimportant and are undoubtedly due to the fact that the type was a little smaller, the diameter of the disk not exceeding 6 mm.

Lyman says that the tentacular oral pores offer two scales on each side; in my specimen I observe three on the interrational side and two or three on the radial side. The following pores have three and sometimes four scales on the proximal and external side. This number then falls to two and remains so on the whole preserved length of the arms, while the distal and internal side generally continues to show three papillæ. These papillæ are not so sharply limited as the external scales, but they are, nevertheless, plainly noticeable; at a certain distance from the arm base the number of these scales falls to two, and finally to one. The mouth shields are wider distally than indicated in Lyman's drawing in the "Reports of the *Challenger*" (82, pl. 5, fig. 16); in the drawing in the Bulletin (78, pl. 4, fig. 87), the distal region is represented wider, but with fairly sharp lateral angles, while these are actually rounded.

The first under brachial plates of *O. elevata* are known to carry in their middle a longitudinal swelling which is characteristic of the species. Lyman says that this swelling is within the disk and he represents it on the first four ventral plates. In my specimen this swelling appears on the first five plates at least. On the first

plate it is wider than on the following ones, and it forms an almost rounded prominence which does not reach the proximal margin. It is on the three succeeding plates that the median protuberance reaches its full development; it is thin, sharp, and extends over the whole length of the plate. On the fifth plate it is less developed, lower, narrower, and does not always reach the proximal margin of the plate. Finally, the sixth plate sometimes shows, in the middle of its distal side, a small conical tubercle. The succeeding plates rapidly become narrower and are longer than wide, and at the same time their proximal angle becomes sharper; they are separated from the ninth or tenth upward.

The upper brachial plates, the form of which has not been indicated by Lyman, are rectangular, and first they are wider than long with a narrow proximal side, a wide and convex distal side, and diverging lateral sides; they afterwards become as long as wide and finally longer than wide.

O. elevata had not yet been met with except in the southern regions of the Indian Ocean, and a single specimen only was known; the discovery of that species in the Atlantic is, consequently, very interesting.

OPHIOGLYPHA FALCIFERA Lyman.

See for bibliography:

Ophioglypha falcifera LYMAN (82), p. 42.

Albatross station 2659. May 3, 1886. Lat. 28° 32' N.; long. 78° 42' W.; 509 fathoms; br. for.; temp. 45.2° F. One little specimen.

OPHIOGLYPHA FASCICULATA Lyman.

Ophioglypha fasciculata LYMAN (83), p. 237, pl. 3, figs. 22-24.

Ophioglypha fasciculata H. L. CLARK (08), p. 296.

Albatross station 2358. Jan. 1, 1885. Lat. 20° 19' N.; long. 87° 03' 30" W.; 222 fathoms; fine wh. co. One specimen.

Albatross station 2666. May 5, 1886. Lat. 30° 47' 30" N.; long. 79° 49' W.; 270 fathoms; gy. s.; temp. 48.3° F. Three specimens.

In the specimen from station 2358 the diameter reaches 14 mm.; the others are smaller, their diameters varying between 7 and 10 mm.

I think I can refer these ophiurans to *O. fasciculata*, for they entirely conform to Lyman's description excepting as regards the number of brachial spines; instead of four, as stated by Lyman, I observe but three, the upper one being remote from the other two which form a small group located near the ventral edge of the arm. The length of these spines reaches two-thirds of the article. Undoubtedly, the spine which ought to be placed in the interspace is lacking, and this is not due to the age of the individuals since the disks of my specimens have diameters ranging from 7 to 14 mm., while the diameter was 13 mm. in Lyman's type. This difference would evidently not justify a specific separation.

Lyman says, as pointed out by H. L. Clark (08, p. 296), that the lateral brachial plates are not in contact either on the upper or on the under face, but in his drawings these plates are represented as being in contact beyond the sixth under brachial plate. I observe on my own specimens that the under plates are in contact for a length which varies, according to the size, from the seventh to the fifteenth article.

Lyman's type was caught by the *Blake* in the waters about Barbados, in a depth of 288 fathoms.

OPHIOGLYPHA INORNATA Lyman.

= *Ophioglypha divisa* Lütken and Mortensen.

See for bibliography:

Køhler (04), p. 40.

Køhler (07), p. 262.

Albatross station 2754. Dec. 5, 1887. Lat. $11^{\circ} 40' N.$; long. $58^{\circ} 35' W.$; 880 fathoms; glob. oz.; temp. $38^{\circ} F.$ Three specimens. The diameter of the disk ranges between 10.5 and 9.5 mm.

I refer to the above-mentioned papers for the variations of *O. inornata*.

In the three examples from the *Albatross*, the upper plates of the disk rather suggest, by their arrangement and the shape of the radial shields, *O. abyssorum*, with which one of the specimens from the *Siboga* also offered some likeness, but the other characters do really correspond with those of *O. inornata*. On the two larger specimens the mouth shields are separated into two halves by a furrow extending over their whole length, as Lyman figured it (82, pl. 3, fig. 10); sometimes, even, the furrow is bifurcated so that the mouth shield is divided into three pieces, but the under plate which comes after it is never divided. On the third specimen, which is somewhat smaller, the mouth shields are entire. In none of these specimens are the upper brachial plates fragmented.

OPHIOGLYPHA IRRORATA Lyman.

Plate 1, figs. 3-4.

See, among other papers, for the bibliography:

Ophioglypha irrorata LYMAN (82), p. 47.*Ophioglypha orbiculata* LYMAN (82), p. 48.*Ophioglypha irrorata* LYMAN (83), p. 243.*Ophioglypha grandis* VERRILL (94), p. 293.*Ophioglypha irrorata* KØHLER (96), p. 19.*Ophioglypha involuta* KØHLER (97), p. 295.*Ophioglypha orbiculata* KØHLER (97), p. 302.*Ophioglypha orbiculata* KØHLER (99), p. 21.*Ophioglypha tumulosa* LÜTKEN and MORTENSEN (99), p. 121.*Ophioglypha tumulosa* LUDWIG (05a), p. 397.*Ophioglypha tumulosa* KØHLER (07), p. 296.*Ophioglypha mundata* KØHLER (07a), p. 257.*Ophioglypha mundata* KØHLER (09), p. 153.*Ophioglypha irrorata* H. L. CLARK (11), p. 62.

Albatross station 2358. Jan. 29, 1885. Lat. $20^{\circ} 19' N.$; long. $87^{\circ} 03' 30'' W.$; 222 fathoms; fne. wh. co. One specimen.

Albatross station 2573. Sept. 2, 1885. Lat. $40^{\circ} 34' 18'' N.$; long. $66^{\circ} 09' W.$; 1,742 fathoms; gy. m. s.; temp. $37.3^{\circ} F.$ Nine specimens.

For the reasons which I give below, one must consider as being synonymous *O. irrorata*, *O. orbiculata* Lyman, *grandis* Verrill, *involuta* Køhler, *tumulosa* Lütken and Mortensen, and *mundata* Køhler. The specimens which I mention above come from the same set as those which were used by Verrill to introduce *O. grandis* and they correspond exactly with the description given by him.

The specimens gathered by the *Albatross* at station 2573 are all very large, the diameter of the disks varying from 20 to 27 mm. None of them is perfectly well preserved and most of the arms are broken more or less close to their bases. I observe in every one of them a radial comb formed by small rectangular papillae which become smaller as they pass over to the under side; Verrill seems to consider this comb as only occasional.

I am glad to have been able to study these examples and to compare their characters with those of the other very closely allied forms which were described under the various names mentioned. It was H. L. Clark who, in his most interesting paper on the Ophiurans from the Northern Pacific (11, p. 62), suggested that *O. irrorata* Lyman, *orbiculata* Lyman, *grandis* Verrill, *involuta* Köehler, and *tumulosa* Lütken and Mortensen, ought to be united in one species to which the name of *O. irrorata* should be applied. The clever American naturalist upheld his opinion by very convincing arguments which have completely satisfied me, the more so as I myself had already had an opportunity to point out the close affinities existing between *O. orbiculata*, *irrorata*, and *involuta*, when I studied the Ophiurans from the *Investigator* (97, pp. 295 and 302). Moreover, I suggest the idea of adding to the synonyms indicated by Clark, *O. mundata*, a species introduced by me in 1907 for an *Ophioglypha* which I had referred at first to *O. irrorata*, as I mentioned recently (09, p. 153). As a basis of distinction between this former species and *O. irrorata*, I had first noted the thickness of the disk, the shape of the mouth shields, and the absence of spines, indicated by Lyman on the upper face of the disk in the latter; these differences are of no more importance than those referred to in order to separate from *O. irrorata* the various species mentioned above by H. L. Clark. Moreover, *O. mundata* differs but slightly from *O. grandis* Verrill, and certainly, had this writer given a drawing of the latter, I should without any hesitation have referred to this species the specimens from the *Travailleur* and the *Talisman* as well as those from the *Princesse Alice* which I denominated *O. mundata*; but one knows how difficult it is to identify the species described by Verrill. Lütken and Mortensen also related their *O. tumulosa* to *O. grandis* and pointed out that, the latter not having been figured, it became very difficult to establish the connection between the two species.

If thus understood, *O. irrorata* has a very wide geographical distribution, which might be compared with that of *Ophiomusium lymani*, as H. L. Clark points out, but the former shows a much more conspicuous polymorphism than the latter. There is no doubt that the differences which have been noticed do not proceed exclusively from the sizes of specimens from the different known localities; after our *Ophioglypha* has been found at a greater number of stations, it will perhaps be useful to keep, for variety's sake, some of the names under which it is known in zoological nomenclature.

In one of the examples gathered by the *Albatross*, which I have illustrated in plate 1, figs. 3 and 4, one of the arms has been broken near its base and includes a restored part which offers certain peculiarities. As seen from the upper face (fig. 4), this arm first shows three normal articles after which come the regenerated articles, the first nine of which display anomalies as to the shape and arrangement of the brachial plates which remind one of those described by me in *Ophionotus*

victoriae (12, p. 118). The dorsal plates, instead of having their usual regularly trapezoidal shape with a wider and convex distal edge, are irregular, much wider than long and most of them are divided into two almost equal parts by a longitudinal furrow located close to the median line. The ventral plates are not so irregular. The first seven keep nearly their normal shape; the eighth one, which is large, is irregularly divided in its distal region; the ninth and tenth plates, smaller than usual, are divided into two by an oblique furrow, and lastly the following plates are scarcely modified. The first two lateral plates on one side carry no spines and the following plate has but two spines; on the other side, the first plate is deprived of spines, the second one has three. Then the succeeding plates on each side generally carry four spines each, the dorsal spine being separated from the other three, and this abnormal arrangement of the spines is continued not only on that part which has abnormal upper and under plates, but also on about ten articles beyond that part. On the other arms of the same example, which never met with an accident, the brachial spines most regularly amount to three, the upper spine being separated from the other two. Verrill, moreover, has pointed out the fact that in *O. grandis* the lower group of spines sometimes included three.

OPHIOGLYPHA LEPIDA Lyman.

Plate 3, fig. 2.

Ophioglypha lepida LYMAN (78), p. 70, pl. 3, figs. 71-73.

Ophioglypha lepida LYMAN (82), p. 43, pl. 4, figs. 1-3.

Ophioglypha lepida LYMAN (83), p. 241.

Ophioglypha lepida VERRILL (85), p. 543.

Ophioglypha lepida KÖHLER (07), p. 294.

Albatross station 2106. Nov. 6, 1883. Lat. 37° 41' 20" N.; long. 73° 03' 20" W.; 1,497 fathoms; glob. oz.; temp. 42.5° F. Twenty-nine specimens.

The specimens are generally of large size; in the smallest one, the diameter of the disk reaches almost 10 mm. and in several others it comes up to 14 or 15 mm. They conform to Lyman's description, excepting with regard to the number of the brachial spines. In fact, I only find as an exception the four spines indicated by him; generally there are but three, two lower ones which form a small group and an upper one which is larger. Verrill also seems to have observed but three spines, for he says: "There is a single larger upper spine rather widely separated from the two lower and much smaller ones, etc."¹ I have never met with the very small spines which are scattered on the upper face of the disk in a var. *spinulosa* introduced by Verrill (85, p. 543).

O. lepida is extremely near *O. lyngmani*, and it would be even more so than Lyman thought if the usual number of its spines were three. I beg to state that in the descriptions given by Lyman of each of these two species there is a contradiction regarding the characters of the radial shields, which is likely to produce confusion. For we read, regarding *O. lepida*, in the very short diagnosis (82, p. 43) which goes before the detailed description: "radial shields touching without," and in the description itself which comes after ² "Radial shields separated on their

¹ Report of the Commissioner of Fish and Fisheries for 1883, 1885, p. 543.

² The voyage of the *Challenger*, Zoology, vol. 5, p. 44, 6th line.

entire length by a wedge of smaller and larger scales." The same contradiction is found, besides, in Lyman's preliminary work (78, p. 70). I consider Lyman's description correct and it is in accordance with the figures he published in 1878 and 1882, and the diagnosis must be corrected in the direction I have just indicated.

As a rule, the two radial shields of each pair are in contact through their distal angle in *O. ljunghmani*; however, it happens sometimes that these shields are somewhat separated from one another distally, but they are always more closely put together than in *O. lepida*, where they remain widely distant from one another. As regards the plates of the upper face of the disk, the drawing published by Lyman in 1878 (78, pl. 3, fig. 72) seems to me to be more correct than that of the Reports of the *Challenger* (82, pl. 4, fig. 3). I may add that *O. lepida* possesses a supplementary radial comb similar to that of *O. ljunghmani*, to which I shall refer when studying the latter species.

In short, *O. lepida* and *O. ljunghmani* are extremely cognate, but the former species is, nevertheless, easily distinguished by its larger size, by the upper plates of the disk being much smaller, almost uniform and finer, by the radial shields being widely separated, and by the upper brachial spine being rather short. These characters are never found in *O. ljunghmani*.

The *Challenger* encountered *O. lepida* at various stations between 38° and 40° N., and 27° and 72° W., in depths ranging from 750 to 1,350 fathoms, and also at 8° S. and 14° W. (420 fathoms). The *Blake* met with it in the West Indies, and also at several more northern localities (41° N., 65° W.; 39° N., 70° W., etc.), in depths ranging from 608 to 1,242 fathoms.

OPHIOGLYPHA LJUNGMANI Lyman.

See for bibliography:

Ophioglypha ljunghmani KEHLER (06), p. 263.

Ophioglypha ljunghmani KEHLER (09), p. 152.

Ophioglypha thouleti KEHLER (09), p. 158.

Albatross station 2102. Nov. 5, 1883. Lat. 38° 44' N.; long. 72° 38' W.; 1,209 fathoms; glob. oz.; temp. 39° F. Four specimens.

Albatross station 2358. Jan. 29, 1885. Lat. 20° 19' N.; long. 87° 03' 30'' W.; 222 fathoms; fine wh. co. One specimen.

Albatross station 2639. Apr. 9, 1886. Lat. 25° 46' 30'' N.; long. 80° 02' W.; 56 fathoms; co. s. One specimen.

Albatross station 2642. Apr. 9, 1886. Lat. 30° 47' 30'' N.; long. 79° 49' W.; 270 fathoms; gy. s.; temp. 42.6° F. One specimen.

Albatross station 2644. Apr. 9, 1886. Lat. 25° 40' N.; long. 80° 00' W.; 193 fathoms; gy. s.; temp. 43.4° F. Five specimens.

Albatross station 2645. Apr. 9, 1886. Lat. 25° 46' 30'' N.; long. 80° 02' W.; 157 fathoms; gn. s.; temp. 43.4° F. Some specimens.

Albatross station 2666. May 5, 1886. Lat. 30° 47' 30'' N.; long. 79° 49' W.; 270 fathoms; gy. s.; temp. 48.3° F. Seven specimens.

Albatross station 2667. May 5, 1886. Lat. 30° 53' N.; long. 79° 42' 30'' W.; 273 fathoms; gy. s. bk. sp.; temp. 48.7° F. Five specimens.

Albatross station 2668. May 5, 1886. Lat. 30° 58' 30'' N.; long. 79° 38' 30'' W.; 294 fathoms; gy. s. dd. co.; temp. 46.3° F. One specimen.

Albatross station 2754. Dec. 5, 1887. Lat. $11^{\circ} 40' N.$; long. $58^{\circ} 33' W.$; 880 fathoms; glob. oz.; temp. $38^{\circ} F.$ Many specimens.

Albatross station 2763. Dec. 30, 1887. Lat. $24^{\circ} 17' S.$; long. $42^{\circ} 48' 30'' W.$; 671 fathoms; br. glob. oz.; temp. $37.9^{\circ} F.$

Grampus station 5118. Mar. 23, 1889. Lat. $26^{\circ} 30' N.$; long. $83^{\circ} 55' W.$; 59 fathoms; hrd. One specimen.

Fish Hawk station 7283. Feb. 19, 1902. Lat. $24^{\circ} 17' 30'' N.$; long. $81^{\circ} 53' 30'' W.$; 127 fathoms; s. gr.; temp. $53^{\circ} F.$ One specimen.

Fish Hawk station 7296. Feb. 26, 1902. Lat. $24^{\circ} 21' 45'' N.$; long. $81^{\circ} 47' 45'' W.$; 122 fathoms; co.; temp. $54^{\circ} F.$ One specimen.

Fish Hawk station 7514. Mar. 25, 1902. Six miles east of Fowey Rocks Light; 200 fathoms; gy. m.; temp. $48^{\circ} F.$ Six specimens.

Fish Hawk station 7512. Mar. 25, 1903. $3\frac{2}{3}$ miles southeast by east of Fowey Rocks Light; 170 fathoms; sft.; temp. $51^{\circ} F.$ Four specimens.

It will be seen from the above table of localities of *O. ljungmani* that the species occurs in depths ranging from 56 to 1,209 fathoms. According to H. L. Clark (01, p. 243), *O. ljungmani* has been found at Porto Rico in depths of 20 to 45 fathoms only. It is not so in the Eastern region of the Atlantic, where *O. ljungmani* has not yet been met with except in very deep waters, about 850–1,100 fathoms.

After studying the very rich series of *O. ljungmani* which has been intrusted to me by the National Museum, I have made sure that *O. thouleti*, which I had introduced in 1896, after a single specimen, and which I had later found fairly abundant in the Echinoderms gathered by the *Travailleur* and the *Talisman*, as well as by the *Princesse Alice*, can not be separated from *O. ljungmani*. The specimens which I formerly referred, and correctly, to this latter species, had always been fairly numerous and of rather small size; they almost always had small spines on the upper face of their disk, but owing to my resolution not to dry them, I was unable to recognize the supplemental radial comb which I thought was a character of *O. thouleti*. Consequently I had been inclined to refer to the latter species the larger specimens in which I easily observed the supplementary radial comb, and which happened not to possess any spines on the upper face of the disk.

In fact, *O. ljungmani* always possesses within the chief radial comb, a series of very fine papillæ which advance to near the middle of the third upper brachial plate, and I do not see, after all, either in the arrangement of the plates of the disk or of the arms, or in the shape of the mouth shields, any character permitting a specific separation between *O. ljungmani* and *O. thouleti*. Consequently the latter can not be considered except as a synonym of the former.

OPHIOGLYPHA LYMANI Ljungman.

See for bibliography:

Ludwig (99), p. 5.

Ludwig (05), p. 73.

Köhler (07), p. 295, pl. 10, figs. 11–12.

Albatross station 2770. Jan. 17, 1888. Lat. $48^{\circ} 37' S.$; long. $65^{\circ} 46' W.$; 58 fathoms; gy. s. bk. sp. Three specimens.

Albatross station 2771. Jan. 17, 1888. Lat. $51^{\circ} 34' S.$ long. $68^{\circ} 00' W.$; 50.5 fathoms; gy. s. bk. sp.; temp. $49.4^{\circ} F.$ Many specimens.

Albatross station 2779. Jan. 23, 1888. Lat. $53^{\circ} 06' S.$; long. $70^{\circ} 40' 30'' W.$; 77.5 fathoms; gn. oz.; temp. $46.9^{\circ} F.$ Two specimens.

Albatross station 2780. Feb. 2, 1888. Lat. $53^{\circ} 01' S.$; long. $73^{\circ} 42' 30'' W.$; 369 fathoms; gn. m.; temp. $46.9^{\circ} F.$ Six specimens.

Albatross station 2783. Feb. 6, 1888. Lat. $51^{\circ} 02' 30'' S.$; long. $74^{\circ} 08' 30'' W.$; 122 fathoms; bu. m.; temp. $47.9^{\circ} F.$ Many specimens.

Albatross station 2784. Feb. 8, 1888. Lat. $48^{\circ} 41' S.$; long. $74^{\circ} 24' W.$; 194 fathoms; bu. m.; temp. $51.9^{\circ} F.$ Many specimens.

OPHIOGLYPHA ROBUSTA (Ayres).

See for bibliography:

Köhler (09), p. 154.

Albatross station 2055. Aug. 30, 1883. Lat. $42^{\circ} 32' N.$; long. $68^{\circ} 17' W.$; 99.5 fathoms; bu. m., s., and ers. g. One little specimen.

OPHIOGLYPHA SARSII (Lütken).

Plate 1, figs. 5-6.

See for bibliography:

Grieg (07), p. 15.

Köhler (09), p. 155.

Süssbach and Breckner (11), p. 248.

H. L. Clark (11), p. 37.

Albatross station 2020. May 21, 1883. Lat. $37^{\circ} 37' 50'' N.$; long. $74^{\circ} 15' 30'' W.$; 143 fathoms; bu. m. fne. s. One specimen.

Albatross stations 2582-2583. Sept. 18, 1885. Lat. $39^{\circ} 50' N.$; long. $71^{\circ} 43' W.$; 131-137 fathoms; gn. m. s.; temp. $47.2^{\circ} F.$ Numerous specimens.

Albatross station 2668. May 5, 1886. Lat. $30^{\circ} 58' 30'' N.$; long. $79^{\circ} 38' 30'' W.$; 294 fathoms; gy. s. dd. co.; temp. $46.3^{\circ} F.$ One specimen.

Albatross station 3456. Sept. 1, 1891. Lat. $48^{\circ} 31' 15'' N.$; long. $124^{\circ} 43' 15'' W.$; 136 fathoms; gy. s.; temp. $44.2^{\circ} F.$ One specimen.

Fish Hawk station 1038. Sept. 21, 1881. Off Marthas Vineyard, Massachusetts; 146 fathoms; s. and sh.; temp. $47^{\circ} F.$ Two specimens.

Fish Hawk station 1111. Aug. 22, 1882. Off Marthas Vineyard, Massachusetts; 124 fathoms; fne. s.; temp. $47^{\circ} F.$ Numerous specimens.

East coast of North America. One specimen.

The specimens from stations 2582-2583 were associated in almost equal number with some *Ophiocten hastatum*; they are all very small, the diameter of their disks never exceeding 12-13 mm.; in some of them this diameter ranged between 2 and 4 mm. I reproduce here two of these small specimens (pl. 1, figs. 5-6). The one from station 3456, the disk of which is 7 mm. in diameter, has short and conical radial papillæ.

The variations of *O. sarsii* are well known, and recently several writers, Grieg, Mortensen, H. L. Clark, and others have written exhaustively about them. The only variations which I observe in the collection of the National Museum refer to the upper plates of the disk which may be more or less protruding.

OPHIOGLYPHA SCULPTILIS Lyman.

(= *Ophioglypha variabilis* Lyman.)*Ophioglypha sculptilis* LYMAN (78), p. 84, pl. 4, figs. 115-116.*Ophioglypha variabilis* LYMAN (78), p. 85, pl. 3, figs. 70, 78, and 79.*Ophioglypha variabilis* LYMAN (78a), p. 217.*Ophioglypha sculptilis* LYMAN (82), p. 59, pl. 6, figs. 16-18.*Ophioglypha variabilis* LYMAN (82), p. 60, pl. 6, figs. 10-12.*Ophioglypha variabilis* LYMAN (82), p. 242.*Ophioglypha sculptilis* KÖHLER (97), p. 301.*Ophioglypha sculptilis* KÖHLER (99), p. 20.*Ophioglypha variabilis* H. L. CLARK (08), pp. 294 and 296.*Ophioglypha sculptilis* H. L. CLARK (11), p. 77.

Albatross station 2656. May 3, 1886. Lat. $27^{\circ} 58' 30''$ N.; long. $78^{\circ} 24'$ W.; 572 fathoms; for.; temp. 41.2° F. One specimen.

Albatross station 2664. May 4, 1886. Lat. $29^{\circ} 41'$ N.; long. $79^{\circ} 55'$ W.; 373 fathoms; co. s.; temp. 42.7° F. Six specimens.

Albatross station 2678. May 8, 1886. Lat. $32^{\circ} 40'$ N.; long. $76^{\circ} 40'$ W.; 731 fathoms; lt. gy. oz.; temp. 38.7° F. Four specimens.

Albatross station 2761. Dec. 26, 1887. Lat. $15^{\circ} 39'$ S.; long. $38^{\circ} 35' 54''$ W.; 818 fathoms; pter. oz.; temp. 39° F. About 15 specimens.

In 1911 H. L. Clark suggested uniting *O. sculptilis* and *O. variabilis*; I quite agree with this opinion, the more so because as far back as 1897 I pointed out that the two species were extremely alike and that the only two characters by which they might be distinguished had but little value. I shall adopt also, as does H. L. Clark, the name *O. sculptilis*. Moreover, Lyman had already reported some variations in *O. variabilis* and I have myself indicated some in *O. sculptilis*.

The specimens of the *Albatross* which I have in hand come from stations which are rather distant from one another, but which are all in the Atlantic; the specimens hardly vary excepting as regards the brachial spines, the number of which is seven or eight at the arm bases, and as regards the separation of the radial shields which is more or less important.

O. sculptilis therefore happens to have a very wide geographical distribution, since it is known in northern as well as in southern Atlantic, in Japanese seas, in the Bay of Bengal, and in East Indian waters.

OPHIOMUSIUM EBURNEUM Lyman.

Ophiomusium eburneum LYMAN (69), p. 322.*Ophiomusium eburneum* LYMAN (71), pl. 2, fig. 13.*Ophiomusium eburneum* LJUNGMAN (71), p. 618.*Ophiomusium eburneum* LYMAN (78), p. 220.*Ophiomusium eburneum* LYMAN (82), p. 99.*Ophiomusium eburneum* LYMAN (83), p. 244.*Ophiomusium eburneum* VERRILL (99), p. 12.*Ophiomusium eburneum*, var. *elegans* VERRILL (99), p. 12, pl. 3, fig. 1.*Ophiomusium eburneum* KÖHLER (07), p. 297.

Albatross station 2376. Feb. 11, 1885. Lat. $29^{\circ} 03' 15''$ N.; long. $88^{\circ} 16'$ W.; 324 fathoms; gy. m.; temp. 46.5° F. Four specimens.

Albatross station 2401. Mar. 14, 1885. Lat. $28^{\circ} 38'$ N.; long. $85^{\circ} 52' 30''$ W.; 142 fathoms; gn. m. brk. sh. One specimen.

Fish Hawk station 7512. Mar. 25, 1903. $3\frac{1}{2}$ miles SE. by E. of Fowey Rocks Light; 170 fathoms; sft.; temp. 51° F. Two specimens.

Fish Hawk station 7513. Mar. 25, 1903. Gulf Stream off Cape Florida, $6\frac{1}{2}$ miles E. S. E. $\frac{1}{2}$ E. of Fowey Rocks Light; 200 fathoms; gy. m.; temp. 46° F. One specimen.

The largest specimens are those from station 2376 in which the diameter of the disk ranges between 15 and 17.5 mm.; the arms, in the largest specimen, reach 52 mm. In the others, the diameter of the disk ranges from 9 to 11 mm.

In these examples, I find variations which are analogous to those formerly indicated by Lyman and Verrill, some of the specimens recalling in certain of their characters, Lyman's description, while the others are more in accordance with Verrill's; in all of them, the spines invariably number two. Verrill thought that the differences observed by him in the specimens gathered by the "Bahama Expedition" were due to the size of the specimens, the diameter of the disk in Lyman's type being 9 mm., while in Verrill's material, this diameter reached 12 mm. But, according to what I have observed, those differences are due not alone to size. Lyman, moreover, reported in 1883 certain variations in the specimens from the *Blake*, and, besides other things, he noted that the brachial spines might amount to three; the diameter of the disk in the largest specimen which he had observed was 15 mm.

The specimens from station 7512 are chiefly in accordance with Lyman's description. The upper brachial plates show, from the base of the arms, the shape of lozenges and remain very small; the radial shields are large, triangular, widely separated; but the mouth shields are longer than indicated by Lyman and their shape is the same as that figured by Verrill.

The specimen from station 2401, although being very near the foregoing ones as far as the size is concerned, differs from them in various respects. The whole body is covered with a yellowish tegument which more or less completely hides the underlying plates. The upper face of the disk with its large triangular radial shields, recalls Lyman's type, but the upper brachial plates are of a different shape. The first one or two of these plates are very short, rectangular, and much wider than long; the third one, also rectangular, is almost as wide as long, with a broad and convex distal side, and a narrower proximal side. The following plates get more elongated, but up to the tenth or twelfth one, they preserve their proximal side distinct, and they do not until afterwards become triangular or lozenge-shaped. The under brachial plates offer nothing particular, but the mouth shields are shorter than on the preceding samples and they recall the shape drawn by Lyman. The brachial spines are extremely short.

The four samples from station 2376 have also their bodies covered with a fairly thick and opaque tegument which hides the outline of the plates. The upper face of the disk recalls the arrangements represented by Verrill, with rather small radial shields which are oval and rather widely separated. The first two upper brachial plates are very short, wider than long and of little importance. The third one, quadrangular, is much wider than long; the fourth is trapezoidal, with a proximal side narrower than the distal side, and it is still a little wider than long.

The succeeding plates progressively assume the shape of a triangle, and then of a lozenge, and they become much smaller. The characters of the under face of the disk and of the arms rather recall those indicated by Verrill, though with the mouth shields somewhat shorter; the brachial spines, which always number two, are identical.

Owing to these variations, I do not think it useful to maintain the variety *elegans* established by Verrill, which is based only upon the number of the brachial spines, which are three in number.

The type of *O. eburneum* described by Lyman came from the coast of Florida, from a depth of 325 fathoms. The *Blake* found the species in the Gulf of Mexico and in the Caribbean Sea, in depths ranging from 92 to 400 fathoms. Verrill's specimens came from off Havana, between 110 and 260 fathoms.

OPHIOMUSIUM LYMANI Wyville Thomson.

See for bibliography:

Kæhler (09), p. 161.

Albatross station 2102. Nov. 5, 1883. Lat. $38^{\circ} 44' N.$; long. $72^{\circ} 38' W.$; 1,209 fathoms; glob. oz.; temp. $39^{\circ} F.$ Twenty-three specimens.

Albatross station 2111. Nov. 9, 1883. Lat. $35^{\circ} 09' 50'' N.$; long. $74^{\circ} 57' 40'' W.$; 938 fathoms; gn. m. Eleven specimens.

Albatross station 2115. Nov. 11, 1883. Lat. $35^{\circ} 49' 30'' N.$; long. $74^{\circ} 34' 45'' W.$; 843 fathoms; m. fne. s.; temp. $39^{\circ} F.$ Fifteen specimens.

Albatross station 2678. May 6, 1886. Lat. $32^{\circ} 40' N.$; long. $76^{\circ} 40' 30'' W.$; 731 fathoms; lt. gy. oz.; temp. $38.7^{\circ} F.$ Many specimens.

Albatross station 2751. Nov. 28, 1887. Lat. $16^{\circ} 54' N.$; long. $63^{\circ} 12' W.$; 687 fathoms; bu. glob. oz.; temp. $40^{\circ} F.$ Many specimens.

OPHIOMUSIUM PLANUM Lyman.

See for bibliography:

Kæhler (09), p. 162.

Albatross station 2097. Oct. 1, 1883. Lat. $37^{\circ} 56' 20'' N.$; long. $70^{\circ} 57' 30'' W.$; 1,917 fathoms; glob. oz. Eleven specimens.

Albatross station 2098. Oct. 1, 1883. Lat. $37^{\circ} 40' 30'' N.$; long. $70^{\circ} 37' 30'' W.$; 2,221 fathoms; glob. oz. Two specimens.

The diameter of the disk ranges between 15 and 22 mm., in a specimen from station 2097 it is only 7 mm.

In the larger specimens, the internal tentacular scale of the first brachial pore is sometimes divided in two as I have pointed out in some samples gathered by the *Princesse Alice* in the Eastern Atlantic (09, p. 162); the brachial spines always remain little developed and vary somewhat as to their number.

OPHIOMUSIUM RUGOSUM, new species.

Plate 1, figs. 7-8.

Albatross station 2342. January 19, 1885. Lat. $23^{\circ} 10' 39'' N.$; long. $82^{\circ} 20' 21'' W.$; 201 fathoms; co. Two specimens.

Type.—Cat. No. 16378, U.S.N.M.

The diameter of the disk is 10 and 12.5 mm. respectively; the arms are incomplete; in the larger specimen they are preserved to a length of 28 mm.

The disk is somewhat thin and its outline is pentagonal. The dorsal face is slightly convex, the ventral face is plane, and the edges are rounded.

The plates of the upper face of the disk are large, few in number, very regularly arranged. There is to be seen one centro-dorsal plate, fairly large, pentagonal, out of which come a first circle of small interradial plates and a second circle of larger radial plates. After the latter come two other radial plates which separate the two radial shields of each pair, one of which is elongated, narrow, triangular, with a truncated distal apex; the other, shorter, is also triangular, but wider than long, with the proximal apex truncated. In the interradial spaces also, two plates successively appear: One, pentagonal and wider; the other, quadrangular, narrower, and more elongated. Beside these, two much smaller plates are observed at the margin of the disk, which are visible also from the ventral face. The radial shields are large, triangular, and separated on their whole length. All the plates of the upper face of the disk are uniformly covered with rounded granules of a fairly large size, but flattened, put close together but not in contact.

The under face of the disk shows in the interradial space and out of the large mouth shield a single plate, which is large, pentagonal, as wide as long, with straight sides, and the obtuse distal angle of which reaches the outer margin of the disk, where the two above-mentioned little plates are also to be seen. The genital plates are fairly large and narrow, four times longer than wide. All these plates are covered with granules identical with those of the upper face; those granules, however, disappear in the proximal region of the genital plates and of the median interradial plate; and they are lacking on the mouth plates. The genital slits, which are found between the adoral plates and the mouth shield, are extremely narrow, short, and scarcely visible.

The mouth shields are fairly large, pentagonal, with an acute proximal angle and straight sides; they are longer than wide. The adoral plates are fairly large and two and a half times longer than wide, with parallel margins. The oral plates are triangular, fairly high. The oral papillæ, the outlines of which are very distinct, amount to five or six on each side. The external papilla, located without the oral plate, is large, wide, quadrangular, and longer than wide; the other papillæ are very much lower: the second and third are rectangular, longer than wide, while the other two or three are smaller. The odd terminal papilla is also very small.

The upper brachial plates are visible only on the smaller specimen, and even there they are altogether rudimental and scarcely distinct; they extend, however, to almost the whole length of the arms. On the larger specimen, the first upper plate alone is preserved, although it remains rudimental, and the following ones have completely disappeared.

The first brachial under plate is rather small, pentagonal, with an obtuse proximal angle, and its distal border is slightly convex; this plate is slightly wider than long. The second plate is large, triangular, with an acute proximal angle and a straight distal side; the lateral borders are sometimes bent into two small sides, united by a very obtuse angle, which gives to the plate a pentagonal shape.

This plate is as wide as long or a little longer than wide, and is placed close to the first one, though not touching it. On each side, and nearer the proximal angle than the distal border, is a slightly developed pore covered with a small rounded scale. The third brachial under plate is very small, triangular, and separated from the foregoing by an interval which is equal to about half its length; on either side of that plate is to be seen a very small pore provided with a rudimental scale, but this pore is generally located on the corresponding lateral brachial plate. Further on, there are no more brachial ventral plates.

The lateral brachial plates alone take up all the inner faces of the arms. They are slightly protruding on the sides, and the successive pairs are separated by a somewhat sinuous furrow, both on the upper and on the under face. Each of them carries five sharp conical spines which are relatively long enough for an *Ophiomusium*.

The granules of the upper face of the disk pass uninterruptedly to the upper part of the lateral plates as well as to their sides, but these granules grow smaller as they are farther from the basis of the arms and more so on the larger specimen; they are completely wanting on the under part of the arms.

Connections and differences.—*O. rugosum* is allied chiefly to *O. granulosum* Lyman and to *O. relictum* Köhler. *O. granulosum*, which was taken by the *Challenger* at a depth of 1,875 fathoms (lat. 34° N.; long. 140° E.), is remarkable owing to the very minute granules which cover the disk plates on both faces and which, instead of being few in number and rounded, are very dense and even grow into little spines on the margins of the plates, including the mouth shields. The oral papillæ are altogether indistinct; moreover, the shape of the mouth shields and of the genital plates, as well as the arrangement of the upper plates of the disk, is different from what is observed on *O. rugosum*.

O. relictum, which was dragged up by the *Siboga* from a depth of 469 meters (lat. 0° 29' S.; long. 130° E.), offers, through the disposition of the upper plates of the disk, a very great likeness to *O. rugosum*, but these plates have no tubercles except near the outline of the disk and their margins are thicker, while they are uniformly granulous in *O. rugosum*, the granulations passing even from the upper face of the disk over to the dorsal and lateral parts of the lateral brachial plates, at least on a certain length of the arms, which gives to the new species a very different appearance. The brachial spines are also more developed in *O. rugosum* than in *O. relictum*.

OPHIOMUSIUM SCULPTUM Verrill.

Plate 1, fig. 9.

Ophiomusium sculptum VERRILL (99), p. 16, pl. 2, fig. 2; pl. 8, fig. 2.

Blake. Two miles east of Havana; 200 fathoms. One specimen.

The species has been described by Verrill after a specimen from Havana which had been dredged between 110 and 260 fathoms.

In the example which was handed to me, the diameter of the disk is 7.5 mm., and the arrangement of the plates of the upper face is not quite in accordance with Verrill's description and drawings; still, I believe it is one and the same species,

and the differences which I noted are due very likely to a difference in the ages of the specimens, Verrill's type being larger than the one I have before me, since its disk reaches 9 mm.

In the specimen from the *Blake*, the upper plates of the disk are fewer; the centro-dorsal plate is directly in contact with the five large radial primary plates, without any intercalary plates lying between them, as stated and figured by Verrill. The radial shields of each pair are contiguous on a part of their length and the triangular plate which separates them distally is as long as wide and may even become a little wider than long. The upper plates of the disk carry fairly large granules, but these, instead of being irregularly scattered over the plates, are located chiefly toward their external margin, a disposition existing especially on the five radial primary plates; these arrangements give to the upper face of the disk a slightly different appearance from that represented by Verrill. The characters of the under face of the disk, of the mouth-pieces, and of the arms being altogether in conformity with those indicated by Verrill, I thought my specimen should be referred to the same species.

OPHIOMUSIUM SERRATUM Lyman.

Ophiomusium serratum LYMAN (82), p. 85, pl. 2, figs. 1-3; pl. 39, fig. 10.

Albatross station 2345. Jan. 20, 1885. Lat. $23^{\circ} 10' 40''$ N.; long. $82^{\circ} 20' 15''$ W.; 184 fathoms; fine. gy. wh. co. One specimen.

OPHIOMUSIUM TESTUDO Lyman.

Plate 3, fig. 7.

Ophiomusium testudo LYMAN (75), p. 8, pl. 1, figs. 6-8.

Ophiomusium testudo LYMAN (78), p. 219.

Ophiomusium testudo LYMAN (82), p. 99.

Ophiomusium testudo LYMAN (83), p. 246.

Ophiomusium testudo VERRILL (99), p. 14.

Ophiomusium testudo KEHLER (07), p. 297.

Albatross station 2342. Jan. 19, 1885. Lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W.; 201 fathoms; co. One specimen.

The specimen is not altogether in conformity with Lyman's description and drawings; it differs from them chiefly in having the upper plates of the disk more regularly arranged and fairly equal in size. By these characters, it is closely allied to two specimens kept at the Jardin des Plantes and collected by the expedition of the *Blake*. These specimens, which were given by Agassiz, were certainly determined by Lyman; the diameter of the disk measures, respectively, 6 and 6.5 mm.; they are consequently a little larger than Lyman's type, the diameter of the disk of which was only 5.5 mm.

In the specimen from the *Albatross*, the diameter of the disk reaches 7 mm.; the arms are preserved to a length not exceeding 10 mm. The disk is pentagonal, with rounded angles. The upper face, fairly convex, is covered with few plates, the size of which is uniform. There is to be seen one large polygonal, centro-dorsal plate, out of which comes a circle of small radial plates, which, moreover,

are irregular; in fact, only three of them are well shaped, the fourth one is rudimentary, and the fifth one completely lacking. Outwardly there is another circle of five larger interradial plates. In each radial space there is a row of three plates; the first one is large and polygonal, even more developed than the centro-dorsal one; the two succeeding ones separate the two radial shields of each pair, but the last one is very small. In each interradial space there is also a row of three plates succeeding the primary interradial one; the first one is about as large as the said primary interradial plate, the second one is a little more elongated, the third one, on the contrary, which is located at the margin of the disk, is transversely widened. Very small plates are sometimes observed between the first and the second interradial plates which I have just indicated. All the plates of the upper face of the disk are plainly polygonal with well-shaped angles, whereas, in Lyman's drawing they are quite rounded, the centro-dorsal one excepted. The radial shields, which are larger than the other plates, are triangular, one and a half times longer than wide, their length being a little inferior to the radius of the disk. They are diverging, close lying or contiguous distally, but separated on their whole length. The arrangement of the upper plates of the disk which I have just described is repeated exactly on the two specimens at the Jardin des Plantes.

The under face of the disk offers, out of the large mouth shield, but one large median plate with a wide proximal side, a fairly opened distal angle and two convex lateral sides; it is a little longer than wide. This shape is very different from that in Lyman's drawing, which shows it to be transversely oval (75, pl. 1, fig. 6). On one of the specimens of the Jardin des Plantes, this median plate does offer the shape which I have just described, but on the other one the proximal side is a little convex, the distal angle is rounded, as well as the lateral sides, so that the outline of this plate tends to become oval, and it is then just as long as wide; in one of the interradial spaces it becomes even slightly wider than long, and it then resembles Lyman's drawing. Two very small plates, which succeed the large median plate and are placed on the margin of the disk, complete the covering of the under face between the genital plates. The latter are very large, elongated, and wide. The genital slits are very small, scarcely distinguishable, and they only appear on a part of the distal side of the adoral plates.

All the upper and under plates of the disk bear rounded granules which are conspicuous and widely separated.

The upper brachial plates are relatively well developed on the specimen from the *Albatross*, and they are larger on Lyman's type and also on the two specimens from the Jardin des Plantes, which, in this respect possess the arrangements described by Lyman. These plates extend the whole length of the arm; the first two, especially, are large, but their size rapidly decreases.

The brachial spines are generally two in number; and yet I sometimes find three, not at the base of the arms but about the middle, and these are found both on the specimen from the *Albatross* and on the two specimens of the Paris Museum.

The type of *O. testudo* was found by the *Hassler* at Barbados at a depth of 100 fathoms; the species was found again by the *Blake* at several stations in the West Indies between 73 and 508 fathoms.

OPHIOMUSIUM VALIDUM Ljungman.

- Ophiomusium validum* LJUNGMAN (71), p. 618.
Ophiomusium validum LYMAN (78), p. 114.
Ophiomusium validum LYMAN (78a), p. 219, pl. 5, fig. 9.
Ophiomusium validum LYMAN (82), p. 92, pl. 1, figs. 1-3; pl. 39, figs. 11-13.
Ophiomusium validum LYMAN (83), p. 246.
Ophiomusium validum KÖHLER (97), p. 307.
Ophiomusium validum KÖHLER (99), p. 25.
Ophiomusium validum H. L. CLARK (01), p. 244.
Ophiomusium validum KÖHLER (04), p. 59.
Ophiomusium validum KÖHLER (07), p. 297.

Albatross station 2350. Jan. 20, 1885. Lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W.; 213 fathoms; co. One specimen.

Albatross station 2636. Apr. 7, 1886. Lat. $23^{\circ} 10' 45''$ N.; long. $82^{\circ} 18' 45''$ W.; 191 fathoms; dead. co. sh.; temp. 62.6° F. One specimen.

Albatross, 1886. Off Havana; no depth mentioned. One specimen.

The diameter of the disk ranges between 9 and 13 mm.

In the drawings of *O. validum* published by Lyman, the two radial shields of each pair are represented as being in contact on almost half their length, but in the descriptions given by the same writer, it is not definitely stated whether the radial shields are contiguous or separated; Lyman simply writes that "they are strongly diverging inward and separated by a triangular scale." Lyman made his description after a specimen, the disk of which was 8.5 mm. in diameter. Now, in the three specimens in hand, the radial shields are separated on their whole length by several successive plates, and in the largest specimen (off Havana), the two internal or radial sides of the shields of each pair are parallel and the interval which separates them is just as wide as the interradsial space. In the other two examples, the radial shields are lying closer distally, even more so in the sample from station 2350, and they are slightly diverging. The arrangement of the radial shields may therefore vary as the age increases. In Ljungman's type, the disk of which was 12 mm. in diameter, the radial shields were "sejuncta intus paullum divergentia."¹ The other characters of my specimens are quite in accordance with Lyman's description and there can be no doubt as to their determination. Besides, I have already had the opportunity of pointing out a few variations in the arrangement of the plates of the upper face of the disk in some specimens from the Indian Ocean (97, p. 307; 99, p. 25; 04, p. 59), and H. L. Clark also made similar remarks regarding the examples which came from Porto Rico (01, p. 244).

O. validum has been found in a great many localities in the Caribbean Sea, between 60 and 1,518 fathoms. The *Investigator* met with it north of the Laccadive Islands (931 fathoms), and the *Siboga* in Moluccan waters (230-600 fathoms).

OPHIOMUSIUM ARMIGERUM Lyman.

Plate 3, fig. 1.

- Ophiomusium armigerum* LYMAN (78), p. 109, pl. 1, figs. 21-22.
Ophiomusium armigerum LYMAN (82), p. 86, pl. 2, figs. 7-9.

Albatross station 2754. Dec. 5, 1887. Lat. $11^{\circ} 40'$ N.; long. $58^{\circ} 33'$ W.; 880 fathoms; glob. oz.; temp. 38° F. One specimen.

¹ Öfv. K. Vet. Akad. Forh., vol. 28, p. 618.

Fish Hawk station 7281. Feb. 14, 1901. Lat. $24^{\circ} 13' 45''$ N.; long. $81^{\circ} 58' 15''$ W.; 304 fathoms; s.; temp. 52° F. One specimen.

The diameter of the disk varies between 5.5 and 8 mm.

In the type described by Lyman, the diameter of the disk was 11 mm. wide. I observe between this type and the two specimens I have in hand, differences of the same kind as those which I have indicated above in *O. validum*, but exactly reversed. The upper plates of the disk are fewer and larger, and the two radial shields of each pair, instead of being parallel as represented by Lyman, are slightly diverging and distally contiguous. The primary plates are, besides, distinct.

OPHIOMISIDIUM, new genus.

This genus is closely allied to the genus *Ophiomusium* and up to now includes only species of very small size. The plates of the upper face of the disk are few and regularly arranged; the interradial spaces of the under face are extremely reduced owing to the more or less considerable widening of the first lateral brachial plates, chiefly of the first two; thanks to that widening, the arms, which, by the way, are very short, are broadly united to the disk and their width very rapidly decreases so that they offer, on the whole, a triangular shape. The first two widened lateral brachial plates carry some well-developed spines which are broad and flattened. Moreover, the first under brachial plate, instead of being rudimental as is normally the case in the genus *Ophiomusium*, offers exactly the same shape as the two following ones, and even exceeds them in size; it displays on each side a tentacular pore provided with a scale located exactly as on the succeeding plates. According to the widening of the first lateral brachial plate being more or less important, the interradial spaces of the under face are more or less reduced and they may even be completely lacking; in the latter case the genital slits also are lacking while they do exist whenever the first lateral plate is less developed.

The genus *Ophiomisidium*, thus defined, includes three species, two of which are already known and had been classified by Lyman in the genus *Ophiomusium*, namely *O. flabellum* and *O. pulchellum*; the third one, which is described below under the name of *O. speciosum*, is new.

Certain peculiarities in the structure of *O. flabellum* and *O. pulchellum* had already been indicated by Lyman, when describing these two species which had been gathered by the *Challenger*. In 1893, in his paper on the *Ophiopus arcticus*, Mortensen formally stated that these two species, being deprived of genital slits, had erroneously been referred to the genus *Ophiomusium* and that they ought to constitute a separate genus (93, p. 525); this naturalist backed his statement also on the peculiar shape of the first under brachial plate and the widening of the first lateral brachial plates. I therefore am simply naming the genus which the learned Danish naturalist proved should be introduced, and yet the genus I am proposing does not absolutely correspond to that which Mortensen conceived. In fact, as stated above, I consider the genus *Ophiomisidium* to be characterized essentially by the shape of the first under brachial plate and by the widening of the first lateral brachial plates, and I introduce only incidentally in the diagnosis the presence or absence of genital slits. Lyman had asserted that the genital slits were lacking in *O. flabellum* and *O. pulchellum*, and Mortensen

admitted that peculiarity which, alone, would be sufficient to justify a generic separation. Now, I have been able to see such slits existing not only on a specimen of *O. pulchellum* gathered by the *Albatross* (station 2625), but also in the new species to which I allude above, *O. speciosum*; these slits are exceedingly small, short, and narrow, but easily discernible, and there can be no doubt as to their presence. The question now is whether the absence of genital slits in *O. flabellum* and their presence in the other two species prevent one from placing all three in the same genus; I do not think so, as all the other characters of their structure which I have observed are in conformity.

It is beyond dispute that, owing to the considerable widening of the first lateral brachial plate which, with its congener, covers the whole interradial under space in *O. flabellum*, there remains no vacant space for the genital slits. But *O. flabellum* is a very small species in which the diameter of the disk does not exceed 3.3 mm., and the arms also are only 3.3 mm. long; the question may be asked whether Lyman's type is not a young specimen, in which case one might imagine that the intercalation of new plates would, as the animal grows older, allow genital slits to be formed. Whichever be the case, it seems to me that the peculiarities displayed in our three Ophiurans by the ventral and lateral brachial plates are amply sufficient to make the introduction of a new genus necessary, and I also think that the three species which I propose to classify in this genus are too closely allied for one of them to be separated from the other two, at least not until the discovery of new specimens has enabled us, by an anatomical study of these forms, to get some information concerning the state of the genital organs, chiefly in *O. flabellum*.

It will perhaps not be useless to recall, in this connection, that in 1904 I introduced a new genus of Ophiurans which also shows a considerable development of the first lateral brachial plate, and to which I gave the name *Ophiomidas* (04, p. 26). I placed in this genus two new Ophiurans gathered by the *Siboga* (*O. alatum* and *O. reductum*), as well as a third species described in 1878 by Lyman and provisionally classified by him, with other species, in the genus *Ophiozona* under the name of *O. dubia* (78, p. 224). It happens that in *O. alatum* and *O. dubium* the disk is very small, its diameter not exceeding 3.5 mm., and the first lateral brachial plate is remarkably widened; in *O. dubium* it even covers on each side half the interradial under space and it joins its congener on the interradial median line; Lyman did not see in that species, nor have I seen in *O. alatum*, any genital slits. On the contrary, in *O. reductum*, which is larger and in which the diameter of the disk reaches from 6 to 7 mm., the genital slits are visible and extend up to the edge of the disk; and yet they are partly hidden by the first lateral brachial plate, which is much less widened than in the other two species.

One of the two chief characters on which the genus *Ophiomisidium* is based, is the very peculiar structure of the first under brachial plate. Instead of being rudimental and compressed on both sides between the adoral plates, and being thus different from the succeeding plates, which are from two to four in number, and are large and provided on each side with a large tentacular pore, such as is most constantly observed in all the known species of the genus *Ophiomusium*, that first ventral plate here takes on a great development, for its size is somewhat superior

to that of the second plate and it immediately acquires such characters as are displayed only on that second plate in the same genus. It shows on each side a large pore provided with a scale, and as this pore corresponds to an ambulacral tube, the result is certainly an important modification in the aquiferous system, such as Mortensen had already pointed out. It is obvious that this structure can not be modified by age, and even if it were proved that the genus *Ophiomisidium* includes only young forms, it would nevertheless constitute a generic character of the utmost value.

The second character of the genus *Ophiomisidium*, that is to say, the widening of the first lateral brachial plates, shows to a variable degree in the three species of that genus which are actually known. It is especially conspicuous in *O. flabellum*, where the first lateral plate is considerably widened and completely covers the interradial under space while at the same time it leans on the median line against the front one and takes the place of the corresponding genital plate; the mouth shield is thus pushed back toward the mouth and remains rudimental. In *O. pulchellum*, the first lateral brachial plate, though very large, does not extend so much over the interradial space, but the latter nevertheless remains very narrow and is bounded chiefly on each side by the genital plate. Lastly, in *O. speciosum*, which I describe below, the first lateral plate is less widened, and on the whole length of the interradial space, from the end of the mouth shield to the margin of the disk, there is a large median plate which separates the genital plates throughout their whole length. In the last two species, the bursæ find, at the lower face of the disk, a sufficient space to make their opening outwardly, which does not seem to be the case in *O. flabellum*.

Type of the genus.—*Ophiomisidium speciosum*, new species.

OPHIOMISIDIUM SPECIOSUM, new species.

Plate 3, figs. 3-4.

Albatross station 2415. Apr. 1, 1885. Lat. $30^{\circ} 44' N.$; long. $79^{\circ} 26' W.$; 440 fathoms; co. crs. s. sh. for.; temp. $45.6^{\circ} F.$ Two specimens.

Albatross station 2761 (type-locality). Dec. 26, 1887. Lat. $15^{\circ} 39' N.$; long. $38^{\circ} 32' 54'' W.$; 818 fathoms; pter. oz.; temp. $39^{\circ} F.$ Four specimens.

Type.—Cat. No. 32291, U.S.N.M.

In the largest specimen from station 2761 the disk is 5 mm. in diameter, the arms are also 5 mm. long; the other specimens are somewhat smaller, and the disk ranges from 3.5 to 4.5 mm. in diameter. The two specimens from station 2415 are very small, the diameter of the disk ranging between 2 and 2.5 mm.

The disk is rounded, thinner at the edges, and is continued, without any well-defined line of demarcation, by the arms; the upper face is very strongly convex, while the under face is plane.

The arrangement of the plates of the upper face of the disk is the same as in *O. pulchellum* Lyman. The central region is occupied by six large primary plates, all being about the same size; the centro-dorsal plate is pentagonal, and the radial plates have a more or less hexagonal outline. Next come, in each interradial space, two successive plates; the first is very large, pentagonal, longer than wide with an

obtuse proximal angle, its lateral borders are parallel and its distal side is straight; the second plate, which is located near the margin, is smaller, transversely widened, and wider than long. The radial shields are large, longer than wide, polygonal and sometimes distally rounded; proximally they touch the corresponding primary radial plate and they are in contact with one another on two-thirds of their length; distally they are separated by a little triangular plate. All these plates are slightly convex, but they do not offer the slightest trace of tuberosity or swelling, such as is observed in *O. pulchellum*; their surfaces are covered only with fine granulations, which are smaller on the plates of the primary rosette and become a little more conspicuous on the plates of the disk margin, where they are, however, less marked than on the arms.

The under face of the disk is very much reduced in the interradian spaces, owing to the considerable widening of the first two brachial articles; this reduction is, however, less marked than in *O. pulchellum*. The middle of each of these spaces is occupied by a large elongated plate succeeding the mouth shield and contiguous to it along its proximal border; this plate, which is narrow in its proximal part, grows wider and wider, so that its distal border, strongly convex, is two or two and a half times wider than the proximal side; the lateral borders are divergent and straight. The distal side of this median plate extends slightly under the interradian plate which occupies the margin of the disk on the upper side, and may be seen when looking at the Ophiuran from the upper side. On each side of the median plate there is a very large and elongated genital plate. The remnant of the under face is occupied by a little triangular plate. The genital slits are small and very short, not exceeding the base of the first lateral brachial plate, but they are, nevertheless, easily recognized; they are slightly fusiform.

The mouth shields are distant from the mouth, owing to the width of the oral and adoral plates, and their middles lie nearer the margin than the center of the disk. They are rather small, pentagonal, about as long as wide, with a fairly open proximal angle limited by two straight sides; the two succeeding sides are about as long as the preceding ones; they join outwardly with a very short and straight distal border. The adoral plates are fairly large, about twice and a half longer than wide, with parallel sides. The oral plates also are well developed and twice longer than wide. The oral papillæ are not distinct and they form a thin, uninterrupted fringe along the oral plates.

All the plates of the under face of the disk are covered with fine granulations, which become a little stronger toward the margin and appear still more so on the brachial plates.

The arms are very broad at their bases, but they always remain quite distinct from the disk; they are relatively short and their length is equal to the diameter of the disk. I count no more than eight brachial articles when looking at the Ophiuran from its upper face, and nine on the under side. The first upper brachial plate is very much wider than long, its proximal side being concave, and its distal side convex; it is in contact with the triangular plate which separates the distal parts of the radial shields. The following plates, which very soon grow extremely small, are triangular; with an obtuse proximal angle and a convex distal side; they

are at first wider than long, they afterwards become as wide as long. They extend up to the ends of the arms and are always very widely separated through the lateral plates. The granules which are to be seen on their surfaces are very fine and much smaller than on the lateral plates; there is no indication of tubercles such as those which are known to exist on *O. pulchellum*.

The first under brachial plate is large and sensibly longer than wide. It is narrowed in its proximal half by the corresponding tentacular pores, while it widens distally; it has an obtuse proximal angle which is more or less rounded, lateral borders which are very concave and a distal side which is widened and convex. The following plates grow rapidly smaller, and they are widely separated by the lateral plates. The form of the second plate resembles that of the first, but it is narrowed to a greater extent in its proximal half, while it widens more in its distal region. This form becomes exaggerated on the succeeding plates, the proximal parts of which finally disappear altogether, when the plates assume the shape of a triangle with an obtuse proximal angle and a most convex distal side. These plates, although much reduced, extend to the ends of the arms.

The lateral plates acquire a very great development chiefly on the under side where the first two, principally, are considerably widened. The first plate is short and very wide; the second, almost as wide as the preceding one, is somewhat longer; the third and the fourth, still narrower, grow longer, and the length rapidly increases in the following plates, while the width decreases more and more, so that the plates are finally much longer than wide. The first lateral plate carries two fairly strong spines, short and flattened, truncated at their ends and with some roughness on their borders; on the second plate the spines, amounting to three, have the same shape as the preceding ones, but they are longer and stronger; the third plate bears two or three spines, and the succeeding plates have only two spines, which rapidly become very small.

The surface of the first lateral brachial plates is strongly granulous. The granules, larger than on the other plates, are rounded and widely separated; they grow finer as they lie nearer the arm ends.

The tentacular pores amount to five pairs on each arm, and they are provided each with one fairly large, rounded scale.

Connections and differences.—*O. speciosum* is closely allied to *O. pulchellum* (Lyman), from which it differs, however, first in having the upper plates of the disk and arms completely deprived of these tuberosities which impart to the upper face of *O. pulchellum* such a characteristic appearance, and also in having the inter-radial underspaces more widened, owing to a lesser development, in breadth, of the first brachial articles. The mouth shield is succeeded by a single median plate; this plate, much elongated and pretty wide, extends from the mouth shield to the margin of the disk and separates the two genital plates on their whole length, which is not the case in *O. pulchellum*, which may offer either the arrangement indicated by Lyman or the one described as *O. pulchellum* from station 2625.

OPHIOMISIDIUM PULCHELLUM (Wyville Thomson).

Ophiomusium pulchellum WYVILLE THOMSON, *The Voyage of the Challenger*, vol. 2, 1877, p. 67, figs. 18-19.

Ophiomusium pulchellum LYMAN (78), p. 118, pl. 5, figs. 144-145.

Ophiomusium pulchellum LYMAN (82), p. 96, pl. 3, figs. 1-3.

Ophiomusium pulchellum LUDWIG (99), p. 2.

Ophiomusium pulchellum KÆHLER (97), p. 266.

Albatross station 2625. Oct. 21, 1885. Lat. $32^{\circ} 35' N.$; long. $77^{\circ} 30' W.$; 247 fathoms; gy. s. bk. sp. One specimen.

The diameter of the disk is 4 mm. and the length of the arms, when measured from their insertion on the disk, is 5 mm.

The upper face of the disk offers the plate arrangement so characteristic of *O. pulchellum* which has been described and figured by Lyman; but on the under face of the disk, in the interradial spaces, I observe a slightly different arrangement from the one indicated by that author. Lyman points out that, following the mouth shield, the two genital plates are contiguous on a large part of their length, and they are separated distally only by a median plate which occupies the margin of the disk. On the specimen from the *Albatross* the mouth shields have their proximal angle more obtuse and the distal edge more rounded and convex. Each of them is followed by a small, short, and rounded median plate which separates the genital plates along a certain part of their interradial edge. Thanks to the intercalation of that plate, which Lyman failed to mention, the two genital plates remain contiguous only on a rather short space, since they are again distally separated by the odd marginal plate, the only one which Lyman does mention on the median interradial line. I had already noticed, in the samples gathered by the *Travailleur* and the *Talisman*, that this median plate was more elongated than in Lyman's type (97 a, p. 266). I may add that, in the individual from the *Albatross*, I have been able to identify the genital slits; these are extremely short and carried back toward the proximal end of the genital plates, but they are nevertheless plainly recognizable. These slits had not been perceived by Lyman, who thought they were lacking, and their discovery is all the more interesting owing to the fact that they also exist in *O. speciosum*.

OPHIOTEN HASTATUM Lyman.

See for bibliography:

Kæhler (99), p. 165.

Albatross station 2415. Apr. 1, 1885. Lat. $30^{\circ} 44' N.$; long. $79^{\circ} 26' W.$; 440 fathoms; co. crs. s. sh. for.; temp. $45.6^{\circ} F.$ Two specimens.

Albatross station 2429. June 13, 1885. Lat. $42^{\circ} 55' 30'' N.$; long. $50^{\circ} 51' W.$; 471 fathoms; gy. m.; temp. $38.7^{\circ} F.$ One small specimen.

Albatross station 2542. July 7, 1885. Lat. $40^{\circ} 00' 15'' N.$; long. $70^{\circ} 42' 20'' W.$; 129 fathoms; s. brk. sh.; temp. $47.2^{\circ} F.$ Two small specimens.

Albatross stations 2582-83. Sept. 18, 1885. Lat. $39^{\circ} 50' N.$; long. $71^{\circ} 43' W.$; 131-137 fathoms; gn. m.; temp. $47.2^{\circ} F.$ Many specimens mixed with numerous *Ophioglypha saratii*.

The diameter of the disk ranges between 3.5 and 10 mm., but is generally about 6 or 7 mm.

Family AMPHIURIDÆ.

OPHIOPHOLIS ACULEATA (Linnaeus).

See for bibliography:

- Kœhler (09), p. 167.
 Grieg (10), p. 4.
 H. L. Clark (11), p. 128.
 Stüssbach und Breckner (11), p. 249.

- Albatross* station 2027. May 25, 1883. Lat. $39^{\circ} 58' 25''$ N.; long. $70^{\circ} 37'$ W.; 198 fathoms; bu. m. and s.; temp. 43° F. Three specimens.
Albatross station 2055. Aug. 30, 1883. Lat. $42^{\circ} 32'$ N.; long. $68^{\circ} 17'$ W.; 99.5 fathoms; bu. m., s., and crs. g. One small specimen.
Albatross station 2063. Aug. 31, 1883. Lat. $42^{\circ} 23'$ N.; long. $66^{\circ} 23'$ W.; 141 fathoms; s. and crs. g.; temp. 46° F. Ten specimens.
Albatross station 2067. Sept. 1, 1883. Lat. $42^{\circ} 15' 25''$ N.; long. $65^{\circ} 48' 40''$ W.; 122 fathoms; s. and g.; temp. 46° F. Nine specimens.
Albatross station 2422. June 3, 1885. Lat. $37^{\circ} 08' 30''$ N.; long. $74^{\circ} 33' 30''$ W.; 85 fathoms; crs. gy. s. bk. sp. brk. sh. Several specimens.
Fish Hawk station 1503. July 22, 1890. Six miles south of Saybrook Light, Connecticut; 16.66 fathoms; m. sh.; temp. 67° F. Three specimens.
Speedwell station 234. Sept. 24, 1878. Off Gloucester, Massachusetts; 43 fathoms; sft. br. m. Two little specimens.
Grampus station 646. Aug. 2, 1894. Lat. $50^{\circ} 07' 00''$ N.; long. $64^{\circ} 03' 30''$ W. Four specimens.
Grampus station 5015. Numerous specimens.
 Davis Strait, 1879. N. P. Seudder (No. 90). Eighteen specimens.
 East coast of North America. Three specimens.

OPHIOSTIGMA ISACANTHUM (Say).

See for bibliography:

- Kœhler (13), p. 363.
 Key West. Eight specimens.
 Key Largo. Nine specimens.
 No Name Key. One isolated disk.
 Banks near Indian Key. One isolated disk.
Fish Hawk station 7293. Feb. 24, 1902. Lat. $24^{\circ} 42' 30''$ N.; long. $81^{\circ} 55' 52''$ W.; $7\frac{1}{2}$ fathoms; co.; temp. 20° C. One specimen.
Fish Hawk station 7419. Jan. 22, 1903. Five-eighths mile N. $\frac{1}{2}$ E. of Hog Key; 7 feet; rky. One specimen.
 In most specimens, the diameter of the disk varies between 3 and 5 mm.
 I made an elaborate study of *O. isacanthum* in the above-mentioned memoir, to which I would respectfully refer the reader.

HEMIPHOLIS ELONGATA (Say).

Ophiura elongata SAY, Journ. Acad. Nat. Sci. Phila., vol. 5, 1825, p. 146.

Ophiolepis elongata MÜLLER and TROSCHEL (42), p. 95.

Ophiolepis elongata STIMPSON (52), p. 225.

Ophiolepis uncinata AYRES (52), p. 250.

Amphiura elongata LÜTKEN (59), p. 115, pl. 3, fig. 1.

Hemipholis cordifera LYMAN (65), p. 137, pl. 1, figs. 1-3.

Hemipholis cordifera LJUNGMAN (66), p. 322.

Hemipholis cordifera LYMAN (82), p. 158.

Hemipholis elongata IVES (89), p. 177.

Hemipholis cordifera KÖHLER (07), p. 298.

One mile inside May River, South Carolina. One specimen.

St. Augustine, Florida. Some dry specimens.

Trinidad. Two specimens.

Rio Janeiro. Three specimens.

I have designated this species by the name of *H. elongata* instead of *H. cordifera*, under which it is usually known, especially since the publication of Lyman's work, first because the name *elongata* had been applied to it by Say in 1825, and again because the term "*cordifera*" has produced some confusion, which I think is due chiefly to Lyman and has never yet been pointed out. In fact, Lyman, who, in 1865, gave an excellent description of the species with which we are dealing, thought that it was the same as had been called by Bosc, in 1830, *Asterias cordifera*. Now, the latter is an *Amphiura* of the *Amphiodia* section, in which the under face of the disk is provided with scales; Lütken gave that synonymy in 1859, when he published a good description and some figures of the said *Amphiodia* which he called *Amphiura cordifera* (Bosc) in his "Additamenta" (59, p. 115); also in 1860,¹ when he called it *Amphiura riisei*. In 1859, in the same volume of the "Additamenta," he published also a good description and some drawings of *Amphiura elongata* (Say). The two species described by Lütken were perfectly distinct, and the descriptions, as well as the figures published by him, were excellent. There would have been, consequently, no difficulty due to synonymy concerning *Hemipholis elongata* had not Lyman, in 1865, adopting the generic name of *Hemipholis* suggested by Agassiz, described *Amphiura elongata* under the name of *H. cordifera*, thus considering this form to be synonymous with *Asterias cordifera* Bosc. Later, in 1882, he published in the *Reports of the Challenger* (82, p. 158) a synonymic list for his *Hemipholis cordifera* which contained the same errors. One can hardly account for Lyman's considering as synonymous two forms so clearly distinct as those which Lütken had so well described and figured under the names of *Amphiura elongata* and *A. cordifera*.

Consequently, for the *Hemipholis* distinguished by Say in 1825 the name of *elongata*, which he had applied to it, must be kept.

¹ Proc. Boston Soc. Nat. Hist., vol. 7, p. 238.

There is now a second question of denomination to be discussed, namely, that referring to the *Amphiodia* which Lütken successively designated as *cordifera* and *riisei*. I have had in hand Lütken's type with the label in this naturalist's own handwriting, and this label reads exactly: "*Amphipholis*.—*Amphiura Riisei* Lütken=*A. cordifera* Lütken." It seems therefore that the name of *riisei* was preferred by him, and considering also that the name *cordifera* might lead to confusion, I feel rather inclined to adopt the former, for, in my opinion, the rule of priority must not be applied with such strictness as to procure inconveniences or facilitate errors. Besides, I beg to point out that the term *cordifera* has been employed only by Ljungman (71, p. 647), who classified this species in the genus *Amphipholis*, but the very few authors who have written about it since, such as Ludwig in 1882 and H. L. Clark in 1901, have designated it under the name of *riisei*. The same denomination was adopted also by Lyman in 1875 (75, p. 128) and in 1882 (82, pp. 125 and 146).

OPHIACTIS ASPERULA (Philippi).

See for bibliography:

Köhler (08), p. 80.

Albatross station 2768. Jan. 14, 1888. Lat. 42° 24' S.; long. 61° 38' 30'' W.; 43 fathoms; dk. s. bk. s. Ten specimens.

Albatross station 2770. Jan. 16, 1888. Lat. 48° 37' S.; long. 65° 46' W.; 58 fathoms; gy. s. bk. sp. Two specimens.

Albatross station 2773. Jan. 17, 1888. Lat. 52° 23' S.; long. 68° 11' W.; 10 fathoms; fne. gy. s. One specimen.

Albatross station 2775. Jan. 18, 1888. Lat. 52° 22' 30'' S.; long. 69° 22' W.; 29.5 fathoms; s. st. Five specimens.

Albatross station 2777. Jan. 19, 1888. Lat. 52° 38' S.; long. 70° 10' 30'' W.; 19.75 fathoms; g. Three specimens.

Albatross station 2778. Jan. 23, 1888. Lat. 53° 01' S.; long. 70° 42' 15'' W.; 61 fathoms; gy. s. bk. sp.; temp. 49.9° F. Seven specimens.

Albatross station 2779. Jan. 23, 1888. Lat. 53° 06' S.; long. 70° 40' 30'' W.; 77.5 fathoms; gn. oz.; temp. 46.9° F. Two specimens.

Coast of Patagonia. Two dry specimens.

OPHIACTIS DISPAR (Verrill).

Albatross station 2146. Apr. 2, 1884. Lat. 9° 32' N.; long. 79° 54' 30'' W.; 34 fathoms; brk. sh.; Several specimens.

Albatross station 2369 (?). Feb. 7, 1885. Lat. 29° 16' 30'' N.; long. 85° 32' W.; 26 fathoms; crs. gy. s. brk. sh. Several specimens.

OPHIACTIS DUPLICATA (Lyman).

See for bibliography:

Köhler (09), p. 171.

Albatross station 2117. Jan. 17, 1884. Lat. 15° 24' 40'' N.; long. 63° 31' 30'' W.; 683 fathoms; yl. m. fne. s.; temp. 39.75° F. Two specimens.

Albatross station 2750. Nov. 27, 1887. Lat. $18^{\circ} 30' N.$; long. $63^{\circ} 31' W.$; 496 fathoms; fne. gy. s.; temp. $44.5^{\circ} F.$ Seven specimens.

The specimens from station 2750 have their first upper brachial plate divided into two almost equal halves, according to the drawing published by Lyman in 1865 (65, pl. 5, fig. 78). In those of station 2117, this plate is single and its disposition is imilar to that depicted by Lyman in the *Reports of the Challenger* (82, pl. 17, fig. 10).

OPHIACTIS MÜLLERI Lütken.

See for bibliography:

Lyman (82), p. 115.

Köhler (07), p. 311.

Albatross station 2146. Apr. 2, 1884. Lat. $9^{\circ} 32' N.$; long. $79^{\circ} 54' 30'' W.$; 34 fathoms; brk. sh. One specimen.

Albatross stations 2369-2374. Feb. 7, 1885. Lat. $29^{\circ} 18'$ to $29^{\circ} 11' N.$; long. $85^{\circ} 32'$ to $85^{\circ} 29' W.$; 25-27 fathoms. A few specimens.

Albatross station 2406. Mar. 15, 1885. Lat. $28^{\circ} 46' 00'' N.$; long. $84^{\circ} 49' W.$; 26 fathoms; crs. s. co. One specimen.

In the sample from station 2406, the diameter of the disk is 3 mm.; the others are smaller and their diameters do not exceed 2 mm. Most have six arms, but some, however, have only five.

OPHIACTIS SAVIGNYI (Müller and Troschel).

See for bibliography:

Köhler (05), p. 26.

Köhler (07), p. 311.

Köhler (13), p. 355.

Albatross station 2374. Feb. 5, 1885. Lat. $29^{\circ} 11' 30'' N.$; long. $85^{\circ} 29' W.$; 26 fathoms; s. g. brk. sh. One specimen.

Albatross station 2409. Mar. 18, 1885. Lat. $27^{\circ} 04' N.$; long. $83^{\circ} 21' 15'' W.$; 26 fathoms; crs. gy. s. brk. sh. One specimen.

Fish Hawk station 7293. Feb. 24, 1902. Lat. $24^{\circ} 42' 30'' N.$; long. $81^{\circ} 55' 52'' W.$; $7\frac{1}{2}$ fathoms; co.; temp. $20^{\circ} C.$ One specimen.

Fish Hawk station 7402. Jan. 7, 1903. Pigeon Key Lake; 9 feet; s. gs. Two specimens.

Fish Hawk station 7405. Jan. 7, 1903. Pigeon Key Lake; 10 feet; rky. One specimen.

Key West. Dec. 2, 1903. Main Ship Channel. One specimen.

Dry Tortugas, 1884. Several specimens.

Spanish Wells, Eleuthera Island, Bahamas. One specimen.

St. Thomas, 1884. Several specimens.

Pernambuco, 1875. One specimen.

Abrothos Islands. Dec. 12, 1887. Several specimens.

No label. One specimen.

All the specimens are provided with six arms, except that of station 2409, which has seven.

AMPHILEPIS NORVEGICA (Ljungman).

See for bibliography:

Köhler (09), p. 181.

Süssbach and Breckner (11), p. 251.

Albatross station 2043. July 30, 1883. Lat. 39° 49' N.; long. 68° 20' 30'' W.; 1,467 fathoms; glob. oz.; temp. 38.5° F. Two specimens.

Albatross, 1883. Off Cape Hatteras. Depth not mentioned. Two specimens. The diameter of the disk ranges between 6 and 9.5 mm. The examples are rather incomplete, especially those from station 2043, in which all the arms are broken from their very bases.

The depth of 1,467 fathoms is rather considerable, but a still greater one (1,608 fathoms) has been noted by Verrill (85, p. 549).

OPHIOPHRAGMUS WUNDERMANI (Lyman).

Plate 8, figs. 1-2.

Amphiura wundermani LYMAN (61), p. 169.

Ophiophragmus wundermani LYMAN (65), p. 132.

Amphiura wundermani LJUNGMAN (71), p. 648.

Ophiophragmus wundermani LYMAN (82), p. 159.

Trinidad. Jan. 30-Feb. 2, 1884. A few examples.

The specimens are quite in conformity with Lyman's descriptions. I notice only that the marginal scales of the upper face of the disk are generally less erect and less distinct than in the other species of the same genus.

O. wundermani has never been figured. I beg to present here two illustrations of one of the specimens in the United States National Museum (pl. 8, figs. 1, 2).

This species had not before been reported except on the coasts of Florida.

OPHIOCNIDA FILOGRANEA Lyman.

Ophiocnida filogranea LYMAN (75), p. 20, figs. 88-89.

Ophiocnida filogranea LYMAN (82) pp. 153 and 155.

Ophiocnida filogranea VERRILL (99a), p. 317.

Cedar Keys, Florida. Six specimens.

Sarasota Bay, Florida. One specimen.

Puntarasa, Florida. Feb., 1884. One specimen.

Charlotte Harbor, Florida. Mar., 1887. One specimen.

The diameter of the disk ranges between 4.5 and 6 mm.

This species belongs to the second group of *Ophiocnida* of Verrill, in which the disk scales are partly bare, partly provided with granules or very short spinules, or both, and in which are included *O. filogranea*, *loveni* (Ljungman) and *littkeni* (Ljungman).

OPHIOCNIDA LOVENI (Ljungman).

Plate 5, figs. 7, 8.

Ophiophragmus loveni LJUNGMAN (66a), p. 165.

Ophiocnida loveni LYMAN (75), p. 21.

Ophiocnida loveni LYMAN (82), pp. 153 and 155.

Ophiocnida loveni VERRILL (99a), p. 317.

Ljungman who first described this species had included it in the genus *Ophiophragmus*. Lyman made of it an *Ophiocnida*, which is more correct, and connects

it with *O. filigranea* (75, p. 21), from which he distinguishes it chiefly by the shape of the oral papillæ. Ljungman's description is fairly complete, but it will not be useless to insist on the differences which separate the two species, since *O. filigranea* is found in the collections gathered by the *Albatross*.

Ljungman's type is preserved in the Stockholm Museum and I have been able to study it, thanks to the kindness of Professor Théel. It is represented only by a single specimen from Rio de Janeiro; the disk is 6 mm. in diameter and the arms are from 30 to 32 mm. long; they are consequently much shorter than in *O. filigranea*.

The upper face is covered with fairly large plates which are unequal and polygonal, without the slightest indication of primary plates. The radial shields are triangular, one and a half times longer than wide and not twice so, as stated by Ljungman; they are contiguous only on half their length and proximally remain separated by a fairly wide triangular space, which is beset by a few plates. The spines do not appear until on the margin of the disk, as is also the case with *O. filigranea*, but they extend over the whole under face, whilst in the latter species, they cover only a peripheric triangular area which is more or less reduced. The mouth shields are about as long as wide and even a little wider than long; they are lozenge-shaped with a truncated distal angle. The adoral plates are rather thick, and wider outwardly than inwardly. The three oral papillæ are flattened and they all come up to the same height, but the external papilla is wider than the others. These various characters of the mouthpieces clearly separate *O. loveni* from *O. filigranea*. Finally, the upper brachial plates are less wide in the former than in the latter species and their shape is rather triangular with an obtuse and rounded proximal angle; the under plates are plainly pentagonal with an obtuse proximal angle instead of being rectangular as in *O. filigranea*.

OPHIOCIDA SCABRIUSCULA (Lütken).

See for bibliography:

Verrill (99a), p. 317.

Key West, Florida. 1885. Eight specimens.

Diameter of disk included between 4 and 6 mm.

AMPHILIMNA OLIVACEA (Lyman).

See for bibliography:

Verrill (99a), p. 318.

Albatross station 2646. Apr. 9, 1886. Lat. 25° 47' N.; long. 80° 05' W.; 85 fathoms; gy. s. for. Twelve specimens.

The arms which are very long, are broken in pieces. The diameter of the disk generally ranges between 5 and 10 mm., and in two specimens it does not exceed 3 mm.

A. olivacea was formerly classified in the genus *Ophiocnida* from which it was removed in 1899 by Verrill who made it the type of his new genus *Amphilimna*.

This species has been met with at several places off the eastern coast of the United States; it extends from Marthas Vineyard as far down as the coasts of Florida and appears also in the West Indies. It lives between 40 and 192 fathoms.

OPHIONEREIS RETICULATA (Say).

See for bibliography:

- Lyman (82), p. 162.
 Lyman (83), p. 253.
 Ives (89), p. 177.
 Lütken and Mortensen (99), p. 162, pl. 13, fig. 10.
 H. L. Clark (01), p. 249.
 H. L. Clark (01a), p. 340.
 Kœhler (07), p. 315.
 Kœhler (07a), p. 274.
 Kœhler (13), p. 360.

Albatross station 2138. Feb. 29, 1884. Lat. $17^{\circ} 44' 05''$ N.; long. $75^{\circ} 39'$ W.; 23 fathoms; co. brk. sh. One specimen.

Albatross station 2758. Dec. 16, 1887. Lat. $6^{\circ} 59' 30''$ S.; long. $34^{\circ} 47'$ W.; 20 fathoms; brk. sh.; temp. 79° F. Several specimens.

Fish Hawk station 7209. Dec. 9, 1901. North Key. Lat. $28^{\circ} 52' 45''$ N.; long. $83^{\circ} 07'$ W.; $5\frac{1}{2}$ fathoms; rky.; temp. 16.1° C. One specimen.

Fish Hawk station 7257. Jan. 28, 1902. Highland. Lat. $27^{\circ} 55' 30''$ N.; long. $83^{\circ} 11' 30''$ W.; 13 fathoms; hrd. and c.; temp. 16.4° C. One specimen.

Fish Hawk station 7429. Jan. 27, 1902. Hawk Channel; 14 feet; rky. One specimen.

Fish Hawk station 7467. Feb. 19, 1902. Grecian Shoals; $2\frac{1}{2}$ fathoms. One specimen.

Key West, Florida. Several specimens.

Indian Key. Eight specimens.

Tortugas Reef. One dry specimen.

Dry Tortugas. One specimen.

Green Cay, Bahamas. One specimen.

Hungry Bay, Bermudas. Four specimens.

Abrolhos Islands. Three specimens.

OPHIONEREIS SQUAMULOSA Kœhler, new name.

Ophionereis squamata Kœhler (13), p. 560, pl. 21, figs. 4-6.

Albatross station 2758. Dec. 16, 1887. Lat. $6^{\circ} 59' 30''$ S.; long. $34^{\circ} 47'$ W.; 20 fathoms; brk. sh.; temp. 79° F. Two specimens.

Diameter of the disk, 2.5 to 3 mm.

I had an opportunity of noting these two specimens when describing the species in the above-mentioned memoir, from an example which had been caught in the West Indies by Messrs. Küenthal and Hartmeyer.

After having described this Ophiuran in 1913, I noticed that the name *Ophionereis squamata* had been applied by Ljungman, in 1866, to the *Ophionereis* which had been described in 1860 by Lyman under the name of *O. porrecta*. Although the first of these words has disappeared from science, owing to its having fallen into synonymy, I propose, in order to avoid all chance of equivocation, to replace the name of *O. squamata* by that of *O. squamulosa*.

OPHIOPSILA RIISEI Lütken.

See for bibliography:

Verrill (99), p. 23.

H. L. Clark (01), p. 246.

Verrill (07), p. 328.

Kehler (07), p. 315.

Albatross station 2649. Apr. 12, 1886. Lat. $23^{\circ} 34' N.$; long. $76^{\circ} 33' W.$; 36 fathoms; co. s.; temp. $74.2^{\circ} F.$ A single arm.

Fish Hawk station 7151. Nov. 7, 1901. Deadman's Bay. Lat. $29^{\circ} 43' 40'' N.$; long. $83^{\circ} 49' 45'' W.$; $5\frac{1}{4}$ fathoms; c.; temp. $20.5^{\circ} C.$ Two specimens.

Fish Hawk station 7467. Feb. 19, 1903. Grecian Shoals, Florida; $2\frac{1}{4}$ fathoms; barry and s. One specimen.

Fish Hawk station 7482. Mar. 7, 1903. Biscayne Bay Key, Florida; $1\frac{3}{4}$ fathoms; barry. One specimen.

Fish Hawk station 7484. Mar. 7, 1903. Biscayne Bay Key, Florida; 2 fathoms; s. grs. One specimen.

Fish Hawk station 7493. Mar. 10, 1903. Card Sound, Florida; $1\frac{3}{4}$ fathoms; barry. One specimen.

Key West, Florida. Three specimens.

Florida. Two dry specimens.

OPHIOPSILA MACULATA (Verrill).

Amphipsila maculata VERRILL (99), p. 55.

Albatross station 2138. Feb. 29, 1884. Lat. $17^{\circ} 44' 05'' N.$; long. $75^{\circ} 39' W.$; 23 fathoms; co. brk. sh. One specimen.

Albatross station 2167. May 1, 1884. Lat. $23^{\circ} 10' 40'' N.$; long. $82^{\circ} 20' 30'' W.$; 201 fathoms; co. One specimen.

The two samples are not in good condition.

AMPHIURA FLEXUOSA Ljungman

Plate 4, figs. 1-2.

Amphiura flexuosa LJUNGMAN (66), p. 319.

Amphiura flexuosa LJUNGMAN (71), p. 643.

Amphiura flexuosa LYMAN (75), p. 17.

Amphiura flexuosa LYMAN (82), pp. 124 and 144.

Amphiura flexuosa H. L. CLARK (01), p. 247.

A. flexuosa was described by Ljungman from a single specimen which came from the Brazilian coast, and which is very likely littoral. The characters of this species were stated again by the same writer in the table of Amphiuridæ published by him in 1871, where he classified it among the species with bare under face of disk. Notwithstanding certain characters which have been plainly, though very briefly, indicated by Ljungman, the species does not seem to have been easily recognized after this writer. Lyman, who had first referred to that species in 1875, an *Amphiura* found in the waters of Barbados at 100 fathoms depth, separates it under the name of *A. palmeri* in the synoptical table of the species of Amphiuræ of the *Challenger*. According to Lyman, this latter species is characterized chiefly by the presence of plates, little apparent, on the under face of the disk, and by the shape of the second and third under spines having each a hook-shaped

extremity. H. L. Clark has reported *A. flexuosa* at Porto Rico in a depth ranging between 162 and 171 fathoms, but he points out that the second under spine of his specimen has its extremity bent. We will see further that Ljungman's type does not offer this character.

I have had in hand a certain number of Amphiuridæ of the West Indies, either from the *Albatross* Expeditions or from Messrs. Kükenthal and Hartmeyer's voyage, some of which have the under face of the disk bare, while the others have it covered with scales; in some of them also the spines are variably bihamuled, and for certain specimens, a comparison with *A. flexuosa* was indispensable. Before anything else, I thought it necessary to determine accurately the characters of this species and to study its type as minutely as possible; thanks to Professor Théel's kindness I was able to secure the loan of this type, and I think it useful to give here a description with some illustrations. Unfortunately, the specimen is not in a perfect state of preservation and the disk is incomplete, but the characters can nevertheless be perfectly well discerned.

Ljungman says that the diameter of the disk is about 7 mm., but it seems to me to scarcely reach that figure; the longest arm is preserved to a length of over 45 mm.

The disk is rounded, very deeply excavated in the interradiar spaces. The upper face is covered with fairly large imbricated plates which are subequal, and become smaller in the middle of the interradiar spaces and a little larger in the vicinity of the radial shields. The latter are triangular, very long and narrow, with a narrow basis and a very acute proximal angle; they are fairly divergent, contiguous distally on about a third of their length and separated proximally by several rows of plates; as indicated by Ljungman, their length is equal to half the radius of the disk.

The upper plates of the disk extend over to the under face and they form around that face a narrow peripheric border which is very sharply limited inwardly, but all the rest of the under face is absolutely devoid of plates; it displays only a thin and transparent tegument, slightly plaited and dark-colored. The genital plates are elongated and narrow; the genital slits are very conspicuous and rather wide.

The mouth shields, almost as long as wide, are rather small and their shape may be compared to a triangle with a strongly convex proximal basis, excavated lateral borders which join, by rounded angles, a straight and narrow distal side which represents the truncated apex of the triangle. It might also be said that these shields have a pentagonal shape with a very obtuse and rounded proximal angle, limited by convex sides, slightly excavated lateral edges, and a small distal edge. The adoral plates are triangular, with an almost straight distal side, and two other deeply excavated sides; these plates are limited to the sides of the mouth shield, and their rounded internal angles are widely separated on the interradiar median line; distally, they become wider and form a narrow blade which separates the mouth shield from the first lateral brachial plate. The oral plates are high and rather narrow. The external oral papilla is conical, spiniform, fairly strong, and ends in an obtuse point; it is obliquely erect; the internal papilla is thick and oval; between these two papillæ there is, on a higher level, an intermediate papilla which is directed horizontally and is of conical shape, but it is thinner and more pointed than the external one.

The upper brachial plates are not very large; they are as a whole rounded or oval, and they can hardly be said to have distinct sides; they offer a narrow proximal side which is slightly excavated at the beginning of the arms and a strongly convex distal side. The first eight or ten plates are rather small, almost as long as wide; they become progressively larger and at the same time wider than long.

The first under brachial plate is small, trapezoidal, with a widened proximal side, a narrow distal side, and diverging lateral sides; it is a little wider than long. The succeeding plates are middle-sized and rather narrow; they are quadrangular, a little longer than wide, with rounded angles, a little more widened in their proximal region; the proximal side is actually divided, at a short distance from the basis, into one fairly wide median side and two little oblique lateral sides. All these plates are contiguous.

The lateral brachial plates carry six spines each as indicated by Ljungman. The first ventral spine is about as long as the article; it is fairly thick, cylindrical, with a rounded point. The following one is a little larger; it is fairly wide at its basis, but it rapidly grows thinner and its point is sharper than that of the foregoing one. Afterwards, the length of the spines decreases very slowly down to the last dorsal one which is lightly flattened but sharp, a shape which was already beginning to appear in the preceding spine. The end of the lateral spines is simply pointed and absolutely straight; it is neither truncated nor bent sideways into a little hook, neither is it provided with spinules; their surface is perfectly smooth on their whole length. The exact shape of the brachial spines of *A. flexuosa* has been correctly observed by Ljungman and in the table of the species of *Amphiuridae* published by him in 1871, he sets *A. semiermis* and *flexuosa* which have "spinæ brachiales acuminatæ, non complanatæ, teretes" in opposition to *A. latispina* and *kinbergi* which have "spinæ brachiales obtusæ, plus minus complanatæ, latiusculæ."

The tentacular brachial pores, rounded, are very large while the tentacular scales, amounting to two, are extremely small; these scales are rounded and arranged oblique to one another; the external scale, which is inserted on the lateral plate, is a little larger than the other and tends to assume an oval shape. These scales do not really take their definite characters until after the first two or three brachial articles on which they may either be lacking or limited to one only.

The color of the specimen in alcohol is whitish on the upper face and brownish on the under face.

Connections and differences.—The species of the genus *Amphiura* (s. lat.) are, generally, separated from one another by very obvious and easily distinguishable characters; if it has sometimes been found difficult to determine them, it has been due more to insufficient descriptions and to the lack of drawings than to the existence of intermediate forms. If we abide by the characters which we have just observed in Ljungman's type, which is evidently the only one which can be taken as a standard, we shall say that *A. flexuosa* is distinguished by the following chief characters:

1. The under face of the disk is bare, the upper plates pass over somewhat to that face in the shape of a marginal and rather narrow border, but the said face may be considered as remaining bare; a like border is often observed in other species

with bare under face of the disk and it is undoubtedly due to a contraction of the tissues of the animal when it was put into alcohol.

2. The tentacular scales amount to two and are all very small.

3. The brachial spines amount to six; they are pointed and absolutely deprived of a terminal hook.

4. The radial shields are very much elongated. The mouth shields display a peculiar shape with a convex proximal side and the external oral papilla is spiniform.

5. Lastly, the upper and under brachial plates are narrow and the latter are longer than wide.

Any *Amphiura* which does not possess the above characters can not be called *A. flexuosa*.

When reporting *Amphiura flexuosa* from Porto Rico, H. L. Clark indicated that the second spine of his example was bent; if we adhere strictly to the above-mentioned characters we may suppose that this was not Ljungman's species. As the specimen comes from a considerable depth (162-171 fathoms), it is, perhaps, an *A. palmeri*.

As regards the latter species, the examination which I was able to make of *A. flexuosa* confirms my opinion that the distinction laid down by Lyman between this species and *A. palmeri* is perfectly justified. The information given by Lyman about *A. palmeri* is, unfortunately, too short; however, the shape of the spines following the first ventral which offer a small, bent, terminal hook is of itself sufficient to separate the two species. One may see also by Lyman's drawings that the mouth shields have a different shape. As to the shape of the external oral papilla, it does not seem to me to have been clearly indicated by Lyman; this writer, in fact, states that it can scarcely be called "spiniform," while in his drawing he represents it as being quite clearly widened and squamiform.

Owing to these facts and the want of a sufficient description, it is very difficult to form an accurate idea of what *A. palmeri* may be. In 1907 (07 a, p. 279) I referred to this species some *Amphiuræ* which came from the expeditions of the *Travailleur* and the *Talisman*, in which the external oral papilla was very thick, conical, and erect, but not squamiform; the under face of the disk was bare, but the brachial spines generally amounted to more than six, and the second and third ones most generally carried at their ends two opposite hooks, which, besides, were often unequal, instead of the single one indicated by Lyman. I am inclined to consider these specimens as belonging to another species and to join them with the *Amphiura* which I describe below under the name of *A. kinbergiensis*. I shall deal with that question again when studying this latter species.

AMPHIURA LATISPINA Ljungman.

Plate 4, figs. 5-6.

Amphiura latispina LJUNGMAN (66), p. 320.

Amphiura latispina LJUNGMAN (71), p. 643.

This species is known only from a single specimen from the mouth of the La Plata River. It is interesting from several points of view, and among others, because it is very near *A. kinbergi*, which I believe I have found again in the collections of the *Albatross*. Unfortunately, the latter species, which was also

introduced by Ljungman, was never described by him and we know it only by the very short comparison which he made between the said species and *A. latispina*. These two species belong, together with *A. flexuosa* and *A. semiermis*, to the group which Ljungman had separated from the other Amphiuridæ under the name of *Hemilepis*, owing to the lack of plates on the under part of the disk. It seems useful to me to describe with some detail *A. latispina*, so as to possess the elements of a comparison with the species which I describe below under the name of *A. kinbergiensis*.

In Ljungman's type the disk is about 7 mm. in diameter, measured between two nonconsecutive angles of the disk, and one of the arms is preserved to a length of nearly 40 mm.

The disk is very strongly excavated in the interradial spaces. The upper face is not uniformly and completely covered with scales, for there is in the middle of each interradial space one triangular region which remains bare. The plates appear first in the central region where they are imbricated, small and equal, and they continue in the direction of the radii, so as to surround each pair of radial shields with a certain number of rows; these plates grow larger and larger as they get nearer to the radial shields. As a rule, the interradial spaces are bare, as I have just stated, but in two of them I observe four or five little rounded plates which are transparent and not in contact. The appearance of the upper face of the disk of this *Amphiura* is consequently rather peculiar. The radial shields are pretty large, elongated, narrow, four or five times longer than wide, and wider distally than proximally; they join distally on one-third of their length, and, proximally, they go progressively apart from each other without, however, becoming very divergent. The very narrow interval which separates them is also quite bare. The length of these shields is almost equal to half the radius of the disk.

The under face of the disk in the interradial spaces is bare; however, in one of these spaces I notice a few rounded plates, which are isolated, very thin, and identical with those which I have reported above in the interradial spaces of the upper face. The genital plates are narrow and elongated and the genital slits are quite apparent.

The mouthpieces are disposed as in *A. flexuosa*, and the mouth shields, especially, have exactly the same shape as in that species. They are triangular, with a very convex proximal side, concave lateral sides, and a truncated distal apex, which forms a small rounded edge; they are as long as wide or slightly longer than wide. The adoral plates are triangular, with more or less concave sides, and they are not contiguous on the interradial median line; but still they are more developed outwardly than in *A. flexuosa* and come very near the median line, so that they compress the first under brachial plate rather strongly between them. The external oral papilla is strong, conical, and elongated, perhaps a little thicker and proportionately somewhat shorter than in *A. flexuosa*.

The first upper brachial plates have also almost the same shape as in *A. flexuosa*. They are oval and rather small, owing to the overgrowth of the lateral plates; the lateral margins are very convex, and the proximal side, less convex, is often broken into two distinct edges joined by a very obtuse angle. They are a little wider than long and they all remain broadly in contact.

The first under brachial plate is very small and extremely narrow, chiefly in its distal part, where it is pressed between the external lobes of the adoral plates; proximally it becomes wider and ends in a very convex margin. The following plates are, as in *A. flexuosa*, almost quadrangular and wider proximally; the proximal side is also bent into three unequal sides, so that the plates finally display a hexagonal shape. They are as wide as long or a little longer than wide; however, they are proportionately a little less elongated than in *A. flexuosa*.

The lateral plates are little protruding, but they cover a rather important part of the upper face of the arms; they first carry six spines but this figure afterwards diminishes to five; these spines are subequal and more or less flattened. The first ventral spine, the length of which somewhat exceeds that of the article, is very much flattened with a rounded point. The second one is a little shorter and rather cylindrical; on the first articles the spine simply ends in a point, but from the seventh or eighth article upward it shows a hyaline terminal hook which rapidly takes on a very great development; this bent hook is analogous to the one which is known in *A. complanata*. However, the angle formed by the hook with the spine is less marked than in this latter species. Ljungman says nothing of the hook in his original description, but in the table of the species of Amphiuroidæ, published by him in 1871, he indicates it as follows: "Spina brachialis ad infimam proxima falciformis in apice acuta." The other spines are more flattened and they tend to assume a lanceolate shape; their width very slightly decreases down to the last one, which is short and very much widened.

There are two tentacular scales, very small, rounded, and subequal; the proximal scale inserted on the lateral plate is, however, a little larger than the other; it is disposed obliquely to the latter. These scales are scarcely visible, and they may even be completely absent on the first three or four brachial articles, but they always appear afterwards in a regular manner and I can not account for Ljungman's saying that they are lacking.

By the above description, it will be seen that *A. latispina* shows great analogies with *A. flexuosa*, but it differs clearly from it by the shape of the brachial spines and by the large bent hyaline hook which terminates the second ventral spine. As to the peculiar disposition of the upper plates of the disk, and the absence of these plates on the interradiial spaces, which somewhat recall the genus *Ophionephthys*, it would be necessary to compare several specimens in order to know if this disposition be accidental in the only known specimen or if it does really characterize the species. The former hypothesis seems to me the most likely one. H. L. Clark pointed out in *A. acrystata* from California and Japan the same disposition of the plates in some specimens (11, p. 146, fig. 58 *a*), whereas in others (fig. 58 *g*) the plates cover the whole upper face of the disk.

AMPHIUROIDEA RATHBUNI, new species.

Plate 18, figs. 5 and 7.

Amphiura flexuosa H. L. CLARK (not Lyman) Bull. U. S. Fish Comm. for 1900, vol. 2, 1901, p. 247.

Fish Hawk station 6066. Jan. 20, 1899. Mayaguez Harbor, Porto Rico; 16 to 17 fathoms; m. s.; temp. 23° C. One specimen.

Typc.—Cat. No. 21295, U.S.N.M.

The diameter of the disk is 7 mm.; the arms are broken off near the base.

This Ophiura was labeled *Amphiura flexuosa* by H. L. Clark, but it is undoubtedly incorrect; in fact, the individual differs from *A. flexuosa* which I have described above to such an extent that it is impossible to refer it to that species; besides, it comes nearer *A. latispina*, but also differs from it, and I consider it to represent a new species.

The disk is pentagonal, excavated in the interradial spaces. The upper face is covered with middle-size plates, which are fairly uniform and regular, imbricated, with no indication of primary plates. They only become a little smaller toward the outline in the middle of the interradial spaces. The radial shields are narrow and rather elongated, three or three-and-a-half times longer than wide, with a very pointed proximal angle; they are hardly divergent and separated on their whole length by a set of plates; their length is inferior to half the radius of the disk. The upper plates stop in a very sharp manner at the periphery of the disk, when they reach the edge of the under face; this face remains bare or provided only with a few very thin scales, which are insulated or united into small groups, but by no means form a regular covering. The genital slits are narrow.

The mouth shields are fairly large, elongated, much longer than broad, and lozenge-shaped, with a truncated and rounded distal angle. The adoral plates are triangular, hardly in contact by their internal angle on the median line. The oral plates are short and thick. The external mouth papilla is erect, somewhat spiniform although short, and slightly flattened with a blunt point; the internal papilla is conical, rather thick, and of middling size. Another papilla, which is almost identical with the external one, but somewhat thicker at its basis, is found between the two preceding ones on a higher level.

The arms are elongated and fairly thin. The upper brachial plates are very large, much broader than long and cover a great part of the upper face of the arms. The first two or three are quadrangular, with a narrow proximal edge, a very wide and strongly convex distal edge, and diverging sides. The following plates take the shape of a biconvex lens, with the two anterior and posterior edges united by rounded angles.

The first under brachial plate is trapezoidal, almost as broad as long, with a narrow and slightly convex distal edge. The following ones are pentagonal, a little wider than long, with a very obtuse and rounded proximal angle and a distal edge which is slightly excavated in its middle. They are all contiguous.

The lateral plates, little protruding, carry five spines each. The first ventral spine is conical with a blunt point, and its total length is equal or slightly superior to that of the article. The second spine, which is a little larger, first has the same shape as the preceding one, then, beyond the disk, its extremity gets elongated and developed into a hyaline hook, which is bent and strongly marked. The third spine, which is shorter than the second and as long as the first, also tends to form a hook at its end, but this hook is less developed and less bent than the foregoing one. The fourth spine is still shorter, and the fifth, which is but little developed, hardly reaches half the article; the last two spines are cylindrical and not very thick.

There are two tentacular scales rather short, subequal and at a right angle.

Connections and differences.—*A. rathbuni* belongs to the group of *Amphiura* s. str. in which the under face of the disk is deprived of a regular covering of plates (*Hemilepis*) and which possesses two tentacular scales. The shape of the second ventral spine prevents its being mistaken for *A. flexuosa*, from which it also differs by its mouth shields being lozenge-shaped, and by its upper and under brachial plates being broader. The shape of the second spine recalls that of *A. latispina*, but in this latter species the last two dorsal spines are large, very much widened and flattened, while they are here slender and cylindrical; the mouth shields, as well as the upper and under brachial plates, are also differently shaped.

A. rathbuni differs still more from the other species of the same group.

It gives me great pleasure to dedicate this new species to Dr. Richard Rathbun.

AMPHIURA KINBERGIENSIS, new species.

Plate 4, figs. 3-4; plate 5, figs. 1-2.

?*Amphiura kinbergi* LJUNGMAN (71), p. 643.

Amphiura palmeri KÖHLER (07a), p. 279.

Fish Hawk station 7512. Mar. 25, 1903. $3\frac{1}{2}$ miles southeast by east of Fowey Rocks Light, Florida; 170 fathoms; sft. Four specimens.

Type.—Cat. No. 32292, U.S.N.M.

I am almost certain that the *Amphiura* which I am going to describe is identical with the one named *A. kinbergi* by Ljungman in 1871, and which he says comes from the southern region of Brazil, without mentioning any depth. Unfortunately, Ljungman has given no description of that species; he only mentions it in the table of the species of *Amphiuridae* of the Atlantic, and he classifies it, with *A. latispina*, among the *Amphiuræ* which have the under face of their disks bare, and which possess two tentacular scales. Both species are characterized by him as having "spinae brachiales obtusae plus minus complanatae latiusculae," and Ljungman says only of *A. kinbergi*: "Spinae brachiales ad infimam proxima recta, in apice truncata, aculeolis minutissimis lateralibus instructa (quasi securiformis)," the two sentences constituting all the description of *A. kinbergi*; the number of spines is not mentioned, but it is certainly near that of *A. latispina*.

Such is the only information we have concerning *Amphiura kinbergi*, which must not be mistaken for the *Amphipholis kinbergi*, which was also described by Ljungman, and which, by the way, ought to be united with *A. squamata*. I had asked Professor Théel to lend me *Amphiura kinbergi* of the Stockholm Museum, but what I received was the *Amphipholis kinbergi*. On my request, Professor Théel was so good as to renew his search among such of Ljungman's species as are kept at the Stockholm Museum, but he could not find *Amphiura kinbergi*, which, according to what he wrote me, no longer exists in the museum. One may, therefore, consider the type of this species as lost. On the other hand, although the particulars given by Ljungman as regards the shape of the spines, the absence of plates on the under face of the disk, the presence of two tentacular scales, and the very close affinities with *A. latispina* allow to a certain extent some deductions to be made, it is obvious that, for want of a complete description, an actual comparison is now impossible, and one can not apply with certainty to an

Amphiura the name of *A. kinbergi*. This term must therefore become a nomen nudum. However, in order to recall its very great likeness to *A. kinbergi*, which is beyond dispute, I propose that the name of *A. kinbergiensis* should be given to the species which is here described.

The diameter of the disk ranges from 4.5 to 5 mm.; the arms are very long, exceeding 70 mm.

The specimens are not in a very good state of preservation; every one of them has several of its arms broken and the disks also are somewhat deformed; however, the examples have quite discernible characters, and they may perfectly well be described and even photographed.

The disk is pentagonal, more or less excavated in the interradial spaces. The upper face is covered with small, unequal, imbricated plates which are smaller in the central region as well as in the interradial spaces and on the margin of the disk and which become larger near the radial shields; there is not the slightest indication of primary plates. The radial shields are elongated and triangular and their shape is slightly variable; sometimes they are a little more elongated, sometimes, on the contrary, they are a little widened. They display a straight and narrow radial side, a very convex interradial side, and they are about three times longer than wide. They are distally contiguous and separated on their whole length by more or less wide spaces, occupied by several rows of plates.

The under face is absolutely bare and its color is always dark. The genital slits are fairly wide.

The mouth shields, middle-sized, are always longer than wide. They are oval or lozenge-shaped, with a rather open and rounded proximal angle, limited by two convex sides; the two posterior sides are about equal in length to the foregoing ones and they meet in a very obtuse angle which is sometimes truncated so as to form a little rounded distal side; the very obtuse lateral angles are more or less rounded, and consequently the shields are now oval, now lozenge-shaped. The rather large adoral plates are triangular; the proximal side and the interradial side are more or less excavated, the third side is smaller and straight. These plates lie near together and generally contiguous on the interradial median line at a very much rounded angle; they become wider outwardly and may even supply a narrow blade which separates the mouth shield from the first lateral brachial plate. The oral plates are fairly elongated. The external oral papilla is strong, thick, conical, and erect, with a more or less blunt point; the internal papilla is wide and thick; an intermediate papilla is located on a somewhat higher level; it is thin, conical, and pointed.

The upper brachial plates are not very large; they are, however, wider than long and rather oval-shaped, with a very convex distal side and plainly rounded lateral sides; they are all in contact.

The first under brachial plate is middle-sized, trapezoidal, and somewhat wider than long, with a wide and convex proximal side, and a narrower distal side toward which converge the lateral sides, which are slightly excavated by the adoral plates. The next plates have a general pentagonal shape, with a very obtuse proximal angle which is truncated, rounded, and more or less indistinct; the

lateral sides, which are almost straight, meet at rounded angles. They are about as long as wide.

The lateral plates, fairly protruding, bear seven and sometimes even eight spines at the base of the arms. The first under spine is strong, thick, and conical with a blunt point; it is at least as long as the article and sometimes even a little longer, and then the length of the spines decreases by degrees down to the last dorsal one. From the first ventral spine upward, all are flattened, especially from the third or fourth one upward, and the last ones take a somewhat lanceolate shape. The spines are located chiefly on the upper part of the arms, and when looking at the animal from the upper face, one perceives at least four spines on each side; an arrangement which accounts for the upper brachial plates being comparatively narrow. The surface of the first ventral spine is rough and the rugosities become coarser near the point, which is rounded. The second spine always has a truncated end; it displays all along its edges very small denticulations which are more developed at the end where they form a fairly regular little row; the last denticulation, which occupies the distal angle, is more developed than the others and constitutes a little transverse, hyaline hook, which is triangular, but always very short. Sometimes, a like formation, which always remains less important, appears at the proximal angle, so that the spine has a tendency to become bihamuled; it will also be seen that the small lateral denticulations of the spine are often more developed on the distal side than on the proximal side. The next two spines, that is to say, the third and fourth ones, display a structure similar to the second one, but the distal hook alone is developed and the lateral denticulations do not appear except on the distal side of the spine. Finally, the other spines simply remain rough at their end, which is rounded.

The tentacular scales, two in number, are at a right angle and middle-sized; the external scale is rounded and it is a little larger than the internal one, which is elongated and less wide.

By comparing, as I have been able to do, the four specimens gathered by the *Fish Hawk* with those of the *Travailleur* and the *Talisman*, to which I had given in 1907 the name of *A. palmeri*, I have been convinced that the latter belong certainly to the same species as the former and that they also ought to be called *A. kinbergiensis*. In fact, the under face of the disk is completely bare, and the other characters offer a striking likeness to those I have just pointed out in *A. kinbergiensis*. I reproduce here two photographs of one of these examples, which will sufficiently illustrate that likeness (pl. 4, fig. 4, and pl. 5, fig. 2). The only difference I can note regards the radial shields which are comparatively a little shorter in the examples of the *Talisman*, but we have seen that the shape of these shields varies in the American examples; the lateral teeth of the spine appear chiefly near the end. These specimens of the *Talisman* were dredged at a depth of 290 fathoms.

Connections and differences.—*A. kinbergiensis* is extremely near *A. latispina* Ljungman, from which it differs chiefly by the presence, on the lateral spines, of denticulations which develop principally at the end of the spines and which replace the large bent hook which terminates the second ventral spine of *A. latispina*. The under brachial plates are more elongated in the latter, the shape of the mouth

shields and perhaps also the arrangement of the upper plates of the disk, separate *A. latispina* from *A. kinbergiensis*.

A. kinbergiensis is also near *A. flexuosa* Ljungman, but the latter has brachial spines which are fewer and pointed, and the mouth shields have a very different shape; there can be no confusion of the two species.

What differences can be pointed out between *A. kinbergiensis* and *A. palmeri*? The two species are certainly very much alike, and their affinities are so great that I confused them in 1907, which confusion was not without excuse, owing to the very vague information we possess regarding the characters of *A. palmeri* and to the absence of specimens making a comparison possible. Now that I have studied the type of *A. flexuosa*, a species so near *A. palmeri* that Lyman at first confused these two forms, and have been able to compare *A. kinbergiensis* with *A. latispina*, the characters of the former appear much clearer to me; unfortunately, these comparisons are incomplete, since I have been unable to study the type of *A. palmeri*, which I know only by the drawings and by a few remarks of Lyman. But it seems to me impossible to unite with an *Amphiura* having seven and sometimes eight brachial spines, a form with five spines only, these figures occurring on such specimens as have about the same size; and Lyman had some examples of *A. palmeri* in which the diameter of the disk reached even 6.5 mm. Moreover, the under face of *A. palmeri* offers some rudimental plates which are completely lacking in *A. kinbergiensis*; lastly, the shape of the second and third brachial spines of my species is not at all as described and figured by Lyman in *A. palmeri*. As regards the external oral papilla, its shape is very different in the two species, if we follow the scheme which Lyman published in 1875 (75, pl. 5, fig. 68); the indications of the text are much less precise, since the writer states only that this papilla can scarcely be called "spiniform," as I stated in 1907. Under these conditions, I thought it necessary to separate the two species.

AMPHIURA PALMERI Lyman.

Plate 18, figs. 1 and 3.

Albatross, 1884. Key West, Florida. Two specimens.

I was very glad to find among the lot of Ophiuræ which were sent to me in 1913, one bottle labeled *Amphiura palmeri*, which was determined by Lyman. These two samples are quite in conformity with this author's descriptions, and by studying them I have been able to solve a few questions which still remained doubtful and to which I have called attention above, such as, among other things, the characters of the under face of the disk, the shape of the external mouth papilla, and the brachial spines.

In the best preserved individual, the photograph of which is reproduced on plate 18, figures 1 and 3, the diameter of the disk is 5 mm. and the length of the arms exceeds 40 mm. As may be seen on the photograph, the under face of the disk is beset all over with plates which form a perfectly uninterrupted covering, succeeding without any lack of continuity the plates of the upper face. The under plates are smaller than the latter, but they are nevertheless very easy to distinguish.

As for the external mouth papilla, it is flattened, a little elongated, and erect; it is somewhat narrower at its basis than at its end, which forms a rounded edge. Thus are explained the contradictions apparently existing between Lyman's descriptions and his drawings.

Lastly, the brachial spines amount to six on the first article and five afterwards. The two spines which succeed the first ventral one terminate each in a little hyaline point, which is conical and sharp, is at a right angle with the spine, and directed toward the end of the arm; the fourth spine still shows a like arrangement, but often less strongly marked. The spines are consequently not bihamuled, the terminal hook being developed on one side only; on the other side the spines show only a few rugosities. Under the terminal hook there may also be observed one or two small denticulations, but these are very weak. The last dorsal spine may show also a little terminal point, which is not so strong as on the preceding spine and is sometimes directed in the axis of the spine and sometimes forms a certain angle with it. The first ventral spine is cylindrical; the others are more or less flattened; chiefly so is the last dorsal one.

The mouth shields show a form slightly different from that figured by Lyman in 1875. In the scheme published by him (75, pl. 5, fig. 68) he ascribes to these shields an almost circular periphery, while on fig. 35, plate 3, the shield is oval. This latter form is nearer to the one I observe on the two specimens which I have in hand, the mouth shields of which are longer than wide and a little narrower in their distal half, which terminates in a little truncated edge. That form recalls the one I have observed and noted above in *A. kinbergiensis*.

In the same bottle there was also a very small individual, the disk of which is only 2.5 mm. in diameter; the arms are all broken at their beginning. I mention this specimen because its primary plates are still visible on the upper face and the plates of the under face are even more distinct than on the two larger specimens, although of no greater size. Moreover, the mouth shields have an almost regular oval shape and their form very much recalls that which Lyman represented in 1875 (pl. 3, fig. 35).

The characters of *A. palmeri* are thus now defined and this species must take place in the section of *Amphiura* s. str., in which the under face of the disk is provided with a regular and uninterrupted covering of plates.

AMPHIURA FIBULATA, new species.

Plate 7, figs. 3-5.

Fish Hawk station 7295. Feb. 24, 1902. Gulf of Mexico. Lat. 24° 38' 40" N.; long. 81° 56' 26" W.; 5½ fathoms; co.; temp. 19.5° C. A single specimen.

Type.—Cat. No. 32293, U.S.N.M.

The disk is 8 mm. in diameter; the arms are incomplete, but some of them are preserved to a length of 70 to 75 mm.; and they must have been much longer.

The disk is rounded. The upper face is covered with imbricated plates, rather uniform, somewhat smaller, however, in the central region and in the middle of the interradi spaces; they become a little larger near the radial shields; on the contrary, near the margin of the disk and in the interradi spaces they rapidly become

smaller. There is not the slightest indication of primary plates. The radial shields are large, rather elongated, three times longer than wide, preserving about the same width in their whole length, and their distal and proximal ends are rounded. The shields of the same pair are not much divergent; distally they are close to each other or in contact, and they are separated proximally at first by one or two successive elongated plates and then by some smaller plates.

The under face of the disk is covered with small, rounded plates, rather loosely put together, and transparent, under which may be seen the underlying tissues which are of a dark color. These plates do not form a very hard covering and they differ from the upper plates, with which they have no continuity at the margin of the disk; but still, they completely cover the under face and extend up to the mouth shields.

The mouth shields are rather large, notably longer than wide, their shapes being almost lanceolate, but their proximal angle is strongly obtuse and rounded and even sometimes semicircular; the lateral angles also are very much rounded and are succeeded by two slightly excavated and convergent lateral edges, which meet at angles which are also rounded, and a small distal side, transverse and almost straight. The adoral plates are somewhat small, triangular, with the three sides concave; the oral margin especially is excavated by the tentacular oral pore which is very large; these plates are hardly contiguous on the median interrational line by their internal ends which are rounded. The middle-sized oral plates are higher than wide; they are terminated by a large, rounded, and obtuse papilla. The external oral papilla located at the meeting point of the oral and adoral plates is little developed, conical, with a rounded end, and is obliquely erect. On a higher level is seen, as usual, a small papilla equal in size to the foregoing, but thinner and more pointed.

The upper brachial plates are small, almost circular at the base of the arms, with a proximal edge slightly excavated. They afterwards become oval in shape, transversely, and a little wider than long, with the distal side more convex than the proximal one. They are all in contact. On the upper median line extends a very light yellowish stripe, which can hardly be distinguished on the specimen in alcohol.

The first under brachial plate is small, narrowed in its distal part, which is compressed between the ends of the adjacent adoral plates and widened proximally. The other plates remain rather small. The second one is quadrangular, somewhat longer than wide, with its proximal margin widened and slightly notched, while the distal edge is smaller and rounded. The succeeding plates are quadrangular, with straight edges and rounded corners; they are hardly longer than wide and are all in contact.

The side plates, little protruding, extend fairly over the upper face of the arms. Each of them carries seven spines, the length of which slightly decreases from the first ventral one, which is equal to the article, down to the last dorsal. The first is cylindrical, rather thick, and has a very rough surface; its rounded end bears very fine denticulations which are more or less conspicuous. The other spines are flattened and their surfaces are always very rough. The second ventral spine is generally bihamuled; however, the two hooks which are at its extremity, and one

of which prolongs the other, are very often unequal, the distal hook being more strongly marked; under these hooks the roughness of the surface of the spine often grows into minute teeth, which are very distinct, there being one or two on each side. The third spine and also the following one present about the same shape; however there is a decreasing tendency in the size of the terminal hooks. The two succeeding spines still offer at their ends two or three small denticulations, but these are very fine and do not incurve sideways. The last dorsal spine, smaller than the others, is almost cylindrical, and its rounded end may still show a very fine spinule.

The tentacular pores are very short, and the ambulacral tubes are large. As a general rule, there is but one tentacular scale; it is very small, flattened, slightly elongated, and rounded at its end, which is rough; it issues from the lateral plate. On the first pores a second scale is often found, smaller, rounded, issuing from the under plate. This second scale is always lacking on the first brachial pore, and is not even constantly present on the succeeding pores. In the following table I give the number of tentacular scales which I observed on the first articles of each arm on each side:

Arm No.	Second article.	Third article.	Fourth article.	Fifth article.	Sixth article.
I.....	2-1	1-2	2-2	2-1	1-1
II.....	2-1	2-2	2-1	1-1	1-1
III.....	1-1	1-2	1-2	1-1	1-1
IV.....	1-1	2-2	2-1	1-1	1-2
V.....	1-1	2-2	1-2	2-2	1-1

Connections and differences.—*A. fibulata* belongs to the section of the *Amphiuræ* s. str., and must be classified under such *Amphiuræ* as have tentacular pores offering but a single scale; but it is distinct from all the species of the same group by the size of the tentacular pores, which contrasts with the reduction of the tentacular scale; by a second scale occasionally existing on the pores included between the second and the sixth pair; by the smallest of the upper and under brachial plates; by the second, third, and fourth brachial spines which are often bihamuled or which offer at least at their ends a little transverse hook; and, lastly, by the slight development of the external oral papilla.

There is no possibility of *A. fibulata* having any affinity either with *A. flexuosa* Ljungman, owing to the presence of plates on the under face of the disk and to the shape of the brachial spines; or with *A. palmeri* Lyman, the spines of which are not bihamuled; moreover, the mouth shields and the external oral papilla of the latter are of a different shape.

Owing to the presence of two tentacular scales on the first pores, although their presence be occasional, one might perhaps look for some affinity of *A. fibulata* with such species as have the under face of the disk covered with scales and which possess two tentacular scales on a more or less extended part of the length of the arms. Under such conditions, the species to which *A. fibulata* would be more closely allied is *A. bihamula* H. L. Clark, owing to the nature of the spines, but it differs from the latter species through the plates of the under face of the disk not being closely joined, but on the contrary remaining wider and looser than on the upper face; it also differs from it through the radial shields being shorter and wider,

through the upper brachial plates being narrower, and, lastly, through the slight development of the tentacular scale, which is always single beyond the first five or six brachial articles, while it remains double, in *A. bihamula*, on two-thirds of the length of the arms.

I have described recently, under the name of *A. kükenthali* (13, p. 386), an *Amphiura*, the under face of the disk of which is covered with fine and regular scaling, extending uninterruptedly until it joins the upper plates, an arrangement very different from the one observed in *A. fibulata*. In this new species, the brachial spines, which come after the first ventral one, bear at their ends a well-developed distal hook, and sometimes also a little proximal hook, which give to some of the specimens a bihamuled appearance, though never so clear as that of *A. fibulata* or of *A. bihamula*; besides, the two tentacular scales are most regularly continued on the longest part of the arms. In short, the two species are altogether different from each other.

I have found in the collections of the United States National Museum a small *A. kükenthali*, which I mention below.

AMPHIURA KÜKENTHALI Kehler.

Amphiura kükenthali KEHLER (13), p. 396, pl. 20, figs. 1-4.

Key West, Florida. One specimen.

The specimen is of very small size and the diameter of the disk does not exceed 4.5 mm., but it entirely agrees with the larger specimens from the West Indies, from which I have just described the species. It was associated with other Ophiurans: *Amphiura abdita*, *Amphiura stimpsoni*, *Ophionereis reticulata*, and *Ophiostigma isacanthum*.

AMPHIURA COMPLANATA Ljungman.

Plate 5, figs. 3-6.

Amphiura complanata LJUNGMAN (66), p. 319.

Amphiura complanata LJUNGMAN (71), p. 642.

Albatross station 2762. December 30, 1887. Lat. 23° 08' S.; long. 41° 34' W.; 59 fathoms; bu. m.; temp. 57.1° F. Several specimens.

A very short description of this species, which, however, is sufficient to recognize it, has been published by Ljungman. I wanted, nevertheless, to compare my specimens with the type which is preserved in the Stockholm Museum, and which has been most obligingly communicated to me by Professor Théel. Ljungman's description being very short, I think it useful to describe the species with a few more details from the specimens gathered by the *Albatross*.

The diameter of the disk generally varies from 7 to 8 mm., and it can reach 10 and 11 mm. In some examples, the disk of which is 10 mm. wide, the length of the arms is from 75 to 80 mm.

The disk is flattened, rather thick, strongly excavated in the interradial spaces, and it also shows some sharp notches above the insertion of the arms. The upper face is covered with numerous, small, unequal, and imbricated plates which are smaller at the center and toward the margin in the interradial spaces, and, on the contrary, larger near the radial shields. On the samples of small or middling size, may be seen a rosette of six primary plates; the centro-dorsal one is rounded and

separated by several rows of small plates from the primary radial ones, which are smaller than the former. The plates grow larger toward the radial shields, as well without as within these shields, and they separate the two shields of each pair by several rows. The radial shields are elongated, with a straight radial side and a convex interradial side; they offer a narrow distal side and a rather sharp proximal angle. Their length is inferior to half the radius of the disk and they are about three times longer than wide. These shields are hardly contiguous distally and they afterwards separate divergently; it even happens sometimes, with the largest specimens, that the shields remain distally separated by a narrow interval.

The very minute plates of the margin of the disk extend uninterruptedly over to the under face, where they remain small, very thick, and strongly imbricated; they are, even, sometimes more or less erect. The genital slits are fairly wide.

The mouth shields are elongated, longer than wide. They are often lozenge-shaped, with a truncated distal angle, and the widest part is more distant from the proximal angle than from the distal side. It may also happen that the shields offer a chief triangular part, almost as long as wide, and that the distal edge then presents in its middle a more or less protruding rounded lobe. The adoral plates are triangular, very thin inwardly, and hardly contiguous on the interradial median line; they are very strongly widened outwardly with more or less concave sides. The oral plates are small. The external oral papilla is conical, spiniform, with an obtuse end which is obliquely erect; the internal papilla is thick, conical, and has its end more or less truncated. A third intermediary papilla, which is thinner than the preceding ones, conical and pointed, is seen on a slightly higher level.

The upper brachial plates are large, much wider than long, with a rounded proximal side, a wide and very convex distal side which is slightly protruding in its middle; the lateral sides are narrow. The proximal and lateral edges often are not very distinct from each other; the plate then takes an almost biconvex shape with a rounded distal side showing in its middle a more protruding part.

The first under brachial plate is small, trapezoidal, with a rounded and narrow distal side, a widened proximal side, and divergent lateral sides. The succeeding ones are pentagonal, rather small, with a very small proximal angle, slightly excavated lateral sides and a straight or slightly excavated distal side. These plates are a little wider than long; they are all contiguous.

The lateral plates bear each six and even seven spines at the basis of the arms. The first ventral spine is cylindrical, swollen at its basis, with a rounded end which slightly exceeds the article. The length of the other spines rapidly decreases down to the last dorsal. The second spine, at least as much developed as the first, begins, at a small distance from the disk, to show at its end a bent and hyaline hook which becomes very strong and joins the spine by a rather well-marked but broadly rounded angle. The other spines are cylindrical with rounded ends, except the last dorsal one, which is rather strongly flattened. The very peculiar character of the second ventral spine was not pointed out by Ljungman in his first description, but in the table of *Amphiuridæ*, which he published in 1871, he says, "*proxima ad infimam geniculata.*"

The tentacular scales, mounting to two, are small, subequal, and lying at a right angle to each other.

Ljungman's type was gathered by Kinberg, at lat. $22^{\circ} 30' S.$ and long. $40^{\circ} 55' W.$; as there is no indication of the depth, the example most likely came from a littoral station; we see that this station is very near the one where the *Albatross* found the species. I do not think that *A. complanata* has been met with elsewhere since the time when Ljungman described it.

AMPHIURA OTTERI Ljungman.

Plate 8, figs. 5-9.

Amphiura otteri LJUNGMAN (71), p. 631.

Amphiura otteri LYMAN (78), p. 32.

Amphiura otteri LYMAN (82), p. 128.

Amphiura otteri LYMAN (83), p. 252.

Amphiura otteri VERRILL (85), p. 548.

Amphiura otteri KÖHLER (07), p. 302.

Albatross station 2003. Off Cape Hatteras; 641 fathoms. Three small specimens the diameter of the disks of which ranges between 6 and 7 mm.; the arms are about 50 to 60 mm. long, but they are generally incomplete; the disks are, however, in good condition.

Albatross station 2838. May 5, 1888. Off Lower California, lat. $28^{\circ} 12' 00'' N.$, long. $115^{\circ} 09' 00'' W.$; 44 fathoms; gn. m. Two specimens. In one of them the disk is 12 mm. in diameter and the arms are broken off near the basis. The second sample is in a better state, the diameter of the disk is 10 mm., the arms are preserved to about 90 mm.; besides, there are in the jar some arm pieces which are 170 mm. long.

Fish Hawk station 898. Off mouth of Chesapeake Bay; 300 fathoms; mud; temp. $44^{\circ} F.$ Two specimens. The diameter of the more or less damaged disks ranges between 9 and 10 mm.; and the arms are preserved to lengths varying between 15 and 50 mm.

Speedwell station 186. August 31, 1878. Eastern point of Gloucester Harbor; about 110 fathoms; muddy. One dry specimen from which the upper face has been taken away; the arms are broken about 20 mm. from their basis.

If we look over the bibliography of *A. otteri* we will ascertain that we do not possess very complete information concerning this species. Ljungman's description is, as usual, rather concise and very short; Verrill added some remarks in 1885. Lyman, who had several specimens of this same species at his disposal and who was able to compare it with Ljungman's type, added nothing to our knowledge. In his synoptical table of *Amphiuræ* published in the Reports of the *Challenger* (82, p. 123) this author classifies *A. otteri* among the species of *Amphiuræ*, s. str., in which both faces of the disk are covered with plates and which at the same time possess two tentacular scales and elongated arms; he characterizes it by the presence of six spines, the most inferior of which is the longest, and one of which is bent. I should like to have given in 1907 more complete information about this species when reviewing the ophiurans of the Paris Museum, which owns a specimen of *A. otteri* from the dredgings of the *Blake*, but owing to the poor state of the under face, which had been damaged by foreign bodies, I was unable to completely recognize the characters of this specimen, and could do no more than represent its upper face. (07, pl. 11, fig. 19.)

The material which is now in my possession has enabled me to make a more detailed study of *A. oteri*, and I am able to add a few complementary facts to the characters already known for this species. I am satisfied that my determinations are correct, for I have been able to compare the specimens of the United States National Museum with the two types of Ljungman, which were most kindly communicated to me by Professor Théel.

The characters of the upper face of the disk are sufficiently well known. I have given a drawing of that face, which, no doubt, is schematic, and I reproduce here photographs of one of Ljungman's types, neither of which is, unfortunately, in a perfect state of preservation (pl. 8, figs. 5 and 6). The radial shields of this are elongated and fairly thin, but in the large specimens of the *Albatross*, as in those from station 2838, they are much wider. The under face is covered in the interradial spaces with plates which, in the larger specimens, are extremely thick and strongly imbricated, so much so that they are more or less obliquely erect.

In Ljungman's type, a photograph of which I give on plate 8, fig. 6, the mouth shields are noticeable through the presence, on the middle of their distal side, of a very well-shaped, wide, and rounded lobe, which strongly protrudes in the interradian space. Ljungman had simply said about it: "*scuta oralia quadrangula marginibus adoralibus convexis marginibusque aboralibus excavatis.*" In short, these shields are a little longer than wide and their chief triangular part is followed by a wide and protruding distal lobe. I do not find exactly that shape in the specimens which were sent to me by the National Museum, or, at least, I find some variations which I think should be noted. In the best preserved specimen, from station 898 (Chesapeake Bay) and which I have represented in plate 8, fig. 7, there is also a very large distal lobe, and therefore the shields are a little longer than wide, almost lozenge-shaped, with a rather obtuse proximal angle and a strongly rounded distal angle. In the other specimens the distal lobe is confused with the rest of the shield; the latter consequently shows an ovoid form and is longitudinally elongated, with rounded proximal and distal angles; sometimes the latter angle is somewhat truncated so as to form a little distal edge. However, on the smaller specimen from station 2838 (diameter of the disk, 10 mm.), the mouth shields again display a chief portion which is triangular and a distal lobe which is wide and distinct. The shape of the mouth shields observed on Ljungman's type does not seem to me to be maintained in a very constant manner, and the distal part may be more or less confused with the rest of the shield, instead of forming a distinct lobe.

The shape of the external oral papilla has been correctly indicated by the authors and it is always found with the same characters: strong, conical, elongated, and obliquely erect.

The arms are extremely long and rather flattened. The upper brachial plates are very large and triangular. On Ljungman's type they display a very obtuse proximal angle and a strongly convex, sinuous distal side, which forms in its middle a rounded and more or less conspicuous swelling (pl. 8, fig. 9). It is perhaps not quite accurate to say that these plates are "*late quadrangula angulis rotundatis marginibus aboralibus excavatis, adoralibus convexis.*" A rather neighboring shape is observed on the two specimens from station 898, but the distal edge is simply convex without the little median swelling, the proximal angle is strongly obtuse,

and one may distinguish very short lateral sides. These sides become more conspicuous on the larger specimen from station 2838, while the proximal angle opening up to 180° is replaced by a distinct side; the lateral margins are divergent and the distal side, very wide and rounded, is sometimes simply convex, sometimes provided with a little median lobe. In a general way, the upper brachial plates are small and narrow at the beginning of the arms, and then they progressively become wider and wider.

The shape of the under brachial plates has been correctly indicated by Ljungman; they are pentagonal, with a truncated proximal angle, and they are somewhat longer than wide (pl. 8, fig. 8). I find again the same shape on all my specimens, but on the smaller example from station 2838 I notice that the proximal angle is more truncated and forms a little proximal side, whereas, on the larger sample from the same station, this angle becomes so much truncated that there is a distinct proximal side, and the plates then take a rectangular shape, which they preserve on the whole length of the arms.

Ljungman states that the spines amount to six or seven at the basis of the arms, and Verrill says that this number may amount to eight on the largest specimens. In most cases I have observed seven. The first spine is conical, thick at the basis, with a rounded point, and its length exceeds that of the article. The second one is almost as long, and afterwards the length decreases with the following ones down to the last dorsal, which is smaller than the article; the last dorsal spines are also somewhat flattened. The second ventral spine is very slightly incurved, and it most often carries at its end a few exceedingly fine spinules. Generally one of these spinules, located at the distal angle of the spine end, is more developed than the others, and then it constitutes a very small lateral hook, which, however, always remains very short; a like structure may also be observed on the two following spines. This hook is more or less apparent according to the specimens. I observe it chiefly on the two specimens from station 898 and on the three specimens from station 2003.

A. otteri has been reported by Ljungman off the Portuguese coasts (lat. $38^\circ 7'$ N.; long. $9^\circ 18'$ W.; 550 fathoms). The *Blake* has found it again in the Caribbean Sea between 175 and 576 fathoms; the *Challenger* has dredged it between 900 and 1,250 fathoms, and, according to Verrill, this species reaches, at Marthas Vineyard, as far down as 1,608 fathoms.

AMPHIURA GRANDISQUAMA Lyman.

See for bibliography:

Köhler (09), p. 177.

Albatross station 2415. Apr. 1, 1885. Lat. $85^\circ 30' 44''$ N.; long. $79^\circ 26'$ W.; 440 fathoms; co. crs. s. sh. for.; temp. 45.6° F. One specimen.

Albatross station 2625. Oct. 21, 1885. Lat. $32^\circ 35'$ N.; long. $77^\circ 30'$ W.; 247 fathoms; gy. s. bk. sp. Nine specimens.

Albatross station 2666. May 5, 1886. Lat. $30^\circ 47' 30''$ N.; long. $79^\circ 49'$ W.; 270 fathoms; gy. s.; temp. 48.3° F. Three specimens.

Albatross station 2753. Dec. 4, 1887. Lat. $13^\circ 34'$ N.; long. $61^\circ 03'$ W.; 281 fathoms; bk. s.; temp. 48° F. One specimen.

AMPHIURA STIMPSONI Lütken.

Plate 7, figs. 1-2.

Amphiura stimpsoni LÜTKEN (59), p. 116.*Amphiura stimpsoni* LJUNGMAN (66), p. 320.*Amphiura stimpsoni* LJUNGMAN (71), pp. 631-634.*Amphiura stimpsoni* LYMAN (75), p. 4, pl. 5, fig. 66.*Amphiura stimpsoni* LYMAN (82), pp. 124-143.*Amphiura stimpsoni* LYMAN (83), p. 252.*Amphiura stimpsoni* MARKTANNER (87), p. 299.*Amphiura stimpsoni* H. L. CLARK (91), p. 247.

Key West. Six specimens.

In one of these specimens the diameter of the disk is about 4 mm.; the others are smaller, the diameter of their disks being comprised between 3.5 and 2 mm.

I have been able to compare with these two specimens the two examples in the Copenhagen Museum which were used as types by Lütken and which were most kindly communicated to me by Doctor Mortensen; I have ascertained their agreement, excepting very slight differences in the shape of the mouth shields. In Lütken's two specimens, the mouth shields are almost triangular, as long as wide, with a fairly sharp proximal angle and a very convex distal side. In my own specimens, I sometimes observe the same shape, but most often the proximal angle is obtuse and rounded, as is the case with the sample photographically reproduced in pl. 7. These shields always remain as long as wide, or sometimes they are very slightly wider than long. The brachial spines amounting to five, are rough, as stated by Lütken, and I find that the small rugosities have even a tendency to develop a little at the end of the spines, and more so on the second ventral one.

Among the authors who, after Lütken, have given some indications regarding *A. stimpsoni*, I can quote only Lyman and Marktanner, but the information given by these two writers is not in accordance with Lütken's description. Lyman published (in 1875) a scheme of the under face on which the mouth shields are represented with a very elongated oval shape; moreover, Marktanner writes that the two dorsal spines have a little aboral hook and that the mouth shields are cordiform, a little longer than wide. Now, these characters, it is evident, do not agree with those observed by me, not only on my own specimens, but on Lütken's two examples, and, in particular, the shape of the mouth shields as represented by Lyman, is altogether incorrect; I am in doubt whether the two above-named writers dealt with the same species.

Lütken suggested that *A. stimpsoni* was a younger form; this is quite possible, but I do not see to which of the known *Amphiuræ* of the West Indies it might correspond. I have compared my examples with very young *A. kükensthalii*, gathered at St. Thomas by Messrs. Kükensthal and Hartmeyer, and I find that the latter possess two tentacular scales, wider upper brachial plates, stronger mouth shields, and their second ventral spine at least already bears its characteristic hook; moreover, the mouth shields have a different shape, for they are elongated and pyriform. Evidently *A. stimpsoni* does not represent a younger form of *A. kükensthalii*.

One might also compare *A. stimpsoni* with the *Amphiura* which I have described above under the name of *A. fibulata*, taking as a basis the fact that the latter has

two tentacular scales only on a few of its first brachial articles, but the scales displayed on the under face of the disk of *A. fibulata* are ill-shaped and different from those of the upper face, its spines are plainly bihamuled and the mouth shields are elongated; there is not the slightest connection between the two species.

A. simpsoni has been reported by Lütken and by Ljungman at various littoral stations of the West Indies. H. L. Clark has noted it at Porto Rico, and, according to Lyman, the *Blake* collected it at Barbados at a depth of 69 fathoms.

AMPHIURA MAGELLANICA Lyman.

See for bibliography:

Kœhler (08), p. 79.

Albatross station 2770. Jan. 16, 1888. Lat. $48^{\circ} 37' S.$; long. $65^{\circ} 46' W.$; 53 fathoms; gy. s. bk. sp.

Four specimens with fragments of the arms. All of them are of rather small size, and, in the largest of them, the diameter of the disk is 5 mm.

AMPHIURA DIDUCTA, new species.

Plate 7, figs. 6-7.

Albatross 1885, off Havana. No depth mentioned. One specimen.

Type.—Cat. No. 32294, U.S.N.M.

The disk is a little over 5 mm. in diameter; the arms are all incomplete; the largest is preserved up to a length of 17 mm.

The disk is pentagonal and pretty deeply excavated in the interrarial spaces. The upper face is depressed centrally as well as in the middle of the interrarial spaces. It is covered with small imbricated plates, subequal, and growing a little larger only in the vicinity of the radial shields; there is not the slightest indication of primary plates. The radial shields are well developed and elongated, three and a half times longer than wide, with an almost straight internal side and a convex external side; they are in contact distally at their distal angles and a little divergent proximally. The two shields of each pair are separated by a chief range of elongated plates which are succeeded by two other ranges of narrower plates. Their length is equal to about half the radius of the disk.

The under face is completely bare. The genital slits are fairly wide.

The mouth shields, of middle size, are lozenge-shaped, as long as wide or a little longer than wide, with a fairly opened proximal angle limited by two straight sides, two lateral sides and a distal margin which is rounded or a little truncated. The adoral plates are triangular, broadly widened without, narrowed, and in contact within. The oral plates are small and short. The two oral papillæ on each side have almost the same shape; the external one, thick, short, and conical, obliquely erect; the internal one, a little more obtuse. Between these two papillæ there is on a higher level another papilla which is thinner, conical, and pointed.

The upper brachial plates are small and narrow, somewhat longer than wide at the basis of the arms, with a narrow proximal margin, a strongly convex distal margin, and lateral borders, divergent and rounded. These plates afterwards become almost as long as wide; they are all in contact.

The first under brachial plate is very small, strongly narrowed in its distal region between the extremities of the adjacent adoral plates which lie very close

together, and it becomes a little wider proximally. The succeeding plates are at first quadrangular with well-rounded angles, and a little longer than wide; they then become pentagonal, with a truncated proximal angle, although they still remain somewhat longer than wide.

The lateral brachial plates, fairly wide, each bear seven spines and sometimes eight at the basis of the arms. These spines are short, nearly equal and their length is next to that of the article; however, the dorsal spines grow slightly shorter down to the last ones. They are slightly flattened and their surface is rough. The lateral spines, and above all the second under spine, are often provided near the rounded end, with two very small diverging denticulations which give them a bihamuled appearance, but this structure is always little developed; sometimes the small denticulations appear on one side only.

The single tentacular scale is thin but fairly long, conical, with an obtuse point; its length does not reach half the corresponding under brachial plate.

Connections and differences.—*A. diducta* belongs to the group of the *Amphiuræ*, s. str., which possess but one tentacular scale and have the under face of their disks bare. It differs from the forms of that group which, by the way, are few, in having numerous brachial spines, large and elongated radial shields and also a fairly long tentacular scale; I see no species to which it might be allied.

AMPHIPHOLIS (=AMPHIURA) SQUAMATA (Delle Chiaie).

See for bibliography:

Køhler (99), p. 179.

Süssbach and Breckner (11), p. 253.

Køhler (13), p. 356.

Albatross station 2645. Apr. 9, 1886. Lat. $25^{\circ} 46' 30''$ N.; long. $80^{\circ} 02'$ W.; 157 fathoms; gn. s.; temp. 43.4° F. One little specimen.

Key West, Florida. One little specimen.

AMPHIPHOLIS (=AMPHIURA) TENUISPINA Ljungman.

See for bibliography:

Køhler (98), p. 53, pl. 6, figs. 22-23.

Albatross station 2619. Oct. 20, 1885. Lat. $33^{\circ} 38'$ N.; long. $77^{\circ} 36'$ W.; 15 fathoms; crs. yl. s. brk. sp. rot. co. One specimen.

The sample, which is of very small size, is identical with the one which Verrill represented (85, pl. 20, fig. 53).

AMPHIPHOLIS (=AMPHIURA) GRACILLIMA (Stimpson).

Amphiura gracillima LYMAN (65), p. 116.

Amphiura gracillima LYMAN (75), pl. 5, fig. 70.

Amphiura gracillima LYMAN (82), p. 146.

Fish Hawk station 7109. Mar. 29, 1901. Tampa Bay, Florida; $6\frac{1}{2}$ fathoms; mud; temp. 20.5° C. Two specimens.

In both specimens the upper face of the disk has been torn away, but the characters of the mouth pieces and of the arms allow, however, the determination of the species with all the certainty which one might wish for.

The arms, very slender, are extremely long and their length may even exceed 10 centimeters. I observe but three brachial spines even at the basis of the arms.

A. gracillima has been met with on the coast of South Carolina.

AMPHIODIA (=AMPHIURA) ERECTA, new species.

Plate 6, figs. 4-7.

Albatross station 2136. Feb. 29, 1884. Off Cape Hatteras. Lat. $17^{\circ} 43' 40''$ N.; long. $75^{\circ} 38' 25''$ W.; 52 fathoms; co. brk. sh. Two specimens.

Type.—Cat. No. 32295, U.S.N.M.

In the larger specimen the disk is somewhat oval and its diameter ranges between 6 and 7 mm. The arms are twisted so that it is impossible to measure exactly their length; two of them are entire and they could not have exceeded about 35 mm. The second specimen is much smaller and the diameter of its disk does not exceed 3 mm., but the arms are comparatively longer and their length ranges between 35 and 40 mm. I will describe this species from the larger specimen.

The disk is rounded and not at all notched in the interradii spaces. The upper face is covered with middle-sized plates, which are fairly thick, a little unequal, little imbricated, and become somewhat larger in the neighborhood of the radial shields; there is not the slightest indication of primary plates. At the margin of the disk certain plates carry a short, wide, and flattened spine with a rounded end; these spines vary in number, but are always few, six or eight in each interradius, and they do not form an interrupted row; most generally they are not observed until about the middle of the interradii spaces, but in one of these spaces they extend to near the radial shields. Some of these spines, shorter than the others, even seem to be a direct extension of the plate which stands erect; it then becomes difficult to tell whether we have to deal here with a spine in the proper sense of the word or with a small plate which stands erect. It is not so with the smaller specimen, where the spines are more numerous and lying closer, and generally form a more regular row; they are comparatively longer and more developed and consequently more distinct than in the larger specimen. The radial shields are small and contiguous over most of their length along their radial edge, which is straight, while the interradii side is strongly convex; they are separated proximally on the fourth or third part of their total length by a very narrow space. These shields are about three times longer than wide, their length being equal to about one-third of the disk radius.

The plates of the upper face of the disk extend without interruption on the under face which they cover entirely, and where they appear imbricated, rounded, and subequal. The genital slits are narrow.

The mouth shields, much elongated, are at least twice longer than wide; they are lozenge-shaped, or more exactly suggest the shape of a boot sole, and their widest part is somewhat nearer the distal than the proximal end. They offer a very rounded and wide proximal angle, two antero-lateral sides which join by obtuse and more or less protruding angles, the two posterior edges which are excavated; the latter are united by an angle, which is also quite rounded and wide and in general truncated so as to represent a short distal side. The adoral plates, located almost entirely on the sides of the mouth shields, have the shape of an elongated and narrow triangle, with the three sides more or less excavated; these plates are

extremely narrowed inwardly, and they are not contiguous on the interradial median line; they grow wider outwardly, but nevertheless remain widely separated from the opposite plate by the first under brachial plate. The oral plates are small and triangular. The oral papillæ amount to three on each side; they are rather obtuse and have about the same shape; the middle one is, however, a little smaller than the other two, the external one is a little widened and triangular, the internal one is more elongated but not very thick; these three papillæ are contiguous and they form a regular row. In the smaller specimen they are uniform, rather short, and flattened.

The upper brachial plates are extremely large and very much widened, almost three times wider than long; they are quadrangular, with a slightly rounded proximal side, an almost straight or even slightly depressed distal side, and short lateral sides, which join the two other sides by rounded angles. They are all widely contiguous.

The first under brachial plate is fairly large, transversely widened, trapezoidal, with a narrow proximal side, a wider distal side and lateral sides which are divergent and excavated. The succeeding plates are very large, pentagonal, much wider than long, with a very obtuse and rounded proximal angle, slightly divergent lateral sides joining by rounded angles the distal side, which is wide and generally a little notched in the middle; the proximal angle may even completely disappear on the first plates, which then become quadrangular. All these plates are contiguous.

The lateral plates, little protruding, each bear three subequal spines which are equal to the article; they are wide, flattened, with a plainly rounded end.

The tentacular scales lie at a right angle; they are equal and semicircular.

The color of the specimens in alcohol is whitish. One can detect, on the upper face of the arms in the larger specimen, a median longitudinal line of a very light brown, and here and there some slightly darker annulations, each of which covers two articles.

Connections and differences.—Owing to the arrangement of the oral papillæ, which are three in number and subequal, this *Amphiura* pertains to the section *Amphiodia* of Verrill. It can not be mistaken for *A. lütkeni* (Ljungman), which bears, on the margin of the disk, some conical, elongated, and sharp-pointed spines, and has its disk covered with very fine plates; the radial shields and the two tentacular scales are more developed in this species than in *A. erecta*, and the arms are extremely long. Further on I shall deal with *A. lütkeni*, which also must be classified in the section *Amphiodia*.

A. erecta closely resembles *A. riisei* Lütken, to which is it akin by the shape of the mouth shields and by the upper and under brachial plates being very wide; but the former differs from the latter by some short, obtuse, and flattened spines standing at the margin of the disk, as well as by the radial shields, and also the upper plates of the disk being smaller, the adoral plates being narrower and more elongated, and the brachial spines being a little longer.

As I wanted, nevertheless, to compare my species more thoroughly with *A. riisei*, I have been temporarily entrusted, thanks to the kindness of Mortensen, with the specimen which was first described by Lütken under the name of *A. cordifera*, and to which he gave, afterwards, the name of *A. riisei*. I can add a few remarks to Lütken's description. The plates of the upper face of the disk of

A. riisei are very large and they have been exactly figured by Lütken, but I observe that, on the margin of the disk, the plates which are succeeded by those of the under face have a tendency to stick up as they do in the genus *Ophiophragmus*, and some of them even elongate to some extent, an arrangement which tends to form a transition toward that which we see in *A. erecta*, where there are actual spines; I even find in the *A. riisei* specimen, at about the middle of one of the interradii, two very distinct little spines which are visible only from the Ophiuran's under face. The mouth shields are a little narrower and more elongated than is shown in Lütken's drawing, where the adoral plates are short and fairly thick; a shape which is consequently altogether different from the one we see in *A. erecta*. The first brachial under plate is broadly widened, and wider than in *A. erecta*, a shape which corresponds to the shortness of the adoral plates.

Lütken has not mentioned the special character displayed on his specimen by the second brachial spine of the first eight or nine articles, that is to say, up to or a little beyond the margin of the disk; each of these conical spines bear at their obtuse end a crown of very short little spinules, which are conical and with rounded points; this crown progressively disappears and is no more visible beyond the disk. I give here a photograph of the under face of the specimen from the Copenhagen Museum (pl. 6, fig. 3).

A. atra (Stimpson) is also very near *A. erecta*; it differs from it, as does *A. riisei*, in having wider mouth shields, smaller brachial spines, separated under brachial plates, wider adoral plates, and no spines on the disk.¹

AMPHIODIA (=AMPHIURA) LÜTKENI (Ljungman).

Plate 6, figs. 1-2.

Amphipholis lütkeni LJUNGMAN (71), p. 631.

When describing, above, *Amphiura erecta*, I referred to *A. lütkeni* because it also has spines at the margin of the disk. We know that *A. lütkeni* has been described by Ljungman from a single specimen found at Tortola, at a depth of 10 fathoms. Having had the opportunity to examine Ljungman's original specimen, which was most kindly lent me by Professor Théel, I can add a few additional facts to Ljungman's description, and I also reproduce two illustrations representing the upper and under faces of this species, which does not appear to have been either seen or mentioned since 1871.

The disk is 6 mm. in diameter. The arms are extremely long; their length can not be exactly measured because they are more or less twisted, but they certainly exceed 80 mm.

The disk is pentagonal, slightly excavated in the interradii spaces; its outline is somewhat irregular in the single specimen which I have in hand. The upper face is covered with small, subequal, thin, and imbricated plates, among which no primary plates can be distinguished; they become a little stronger near the radial shields and near the margin of the disk in the interradii spaces. On this same margin are seen a certain number of fairly strong, elongated, conical, and pointed spines which are sometimes bent; there are also about 10 such spines in each inter-

¹ While this memoir was passing through the press I received from the United States National Museum three specimens of *A. riisei* in a rather bad state; the words on the label were almost erased and I am unable to indicate their origin.

radius. The radial shields are narrow, elongated, almost four times longer than wide, with a convex internal side and a sharply pointed proximal apex. Their length is inferior to half the radius of the disk; distally, they are contiguous on about one-third of their length, and, proximally, they are separated by a few rows of plates, but they are not very divergent.

The under face of the disk is covered all over with very thin, imbricated, and equal plates, which uninterruptedly succeed those of the upper face. The genital slits are narrow.

The mouth shields are lozenge-shaped and longer than wide, with four equal sides and rounded angles, especially the lateral angles, which are very obtuse. The adoral plates, of middling size, are triangular, with three more or less concave sides; they are widened outwardly, and one can see a thin blade which separates the mouth shield from the first lateral brachial plate. The oral plates are low. The oral papillæ, amounting to three, are subequal, short, rather thick with a blunt point; the internal papilla, however, is a little more elongated than the other two.

One can scarcely distinguish on the middle of the upper face of the arms the dark longitudinal line indicated by Ljungman. The dorsal plates are large and extremely wide, at least three times wider than long, with an almost straight proximal side, a wider distal side, which is sometimes a little depressed in its middle, and strongly rounded lateral sides joining the two other sides by angles which are also rounded. These plates are sometimes split into two lateral halves by a furrow near their middle, and sometimes the number of pieces is even larger, owing to there being two or three irregular furrows. All these plates are contiguous.

The first under brachial plate is fairly long, triangular, with a truncated proximal angle and a strongly convex distal side. The succeeding ones are pentagonal, much wider than long, with a very obtuse and rounded proximal angle, and straight sides which meet by rounded angles.

The lateral plates are little protruding. They carry three fairly wide, flattened slightly lanceolate spines, the point of which is obtuse and rough; these spines are about the same length and they equal the article.

The tentacular scales, two in number, are subequal and rather large; the external scale, supported by the lateral brachial plate, is rounded; the internal one, which is inserted on the ventral plate, is more elongated.

A. lütkeni has been classified by Ljungman in the genus *Amphipholis* which, according to him, included such species as have three oral papillæ on each side, the external papilla being either wider or narrower than the other two. As, in *A. lütkeni*, the three papillæ are subequal, this species must be placed in the section *Amphiodia* of Verrill.

AMPHIODIA (=AMPHIURA) PULCHELLA (Lyman).

Amphiura pulchella LYMAN (69), p. 337.

Amphiura pulchella LJUNGMAN (71), p. 648.

Amphiura pulchella LYMAN (75), pl. 5, fig. 75.

Amphiura pulchella LYMAN (82), pp. 125 and 147.

Amphiodia pulchella H. L. CLARK (01), p. 248.

Albatross station 2765. Jan. 12, 1885. Lat. 36° 43' S.; long. 56° 23' W.; 10.5 fathoms; s. brk. sh. Five specimens.

Albatross; Port Castries, Santa Lucia. One specimen.

Dry Tortugas, Florida. Seven specimens.

The description which Lyman gave in 1869, as well as the scheme of the mouth pieces published by him in 1875, is quite sufficient to make known this species which belongs to Verrill's *Amphiodia* section, and is easily identified by the under face of the disk being covered with scales which succeed those of the upper face, and by the single tentacular scale. All my examples are in accordance with that description, except that I do not always find the primary plates to be distinct, even on small specimens.

A. pulchella has been met with on the coasts of Florida between 18 and 39 fathoms. H. L. Clark has noted it also at Porto Rico, while it has been taken at Santa Lucia by the *Albatross* as well as at Dry Tortugas.

I was greatly surprised to find this species in a tube bearing the label of station 2765, that is to say of a locality lying much farther south of the localities just mentioned, but there can be no mistake as to the determination as the specimens altogether agree with the others. If there has been no mistake in the labelling *A. pulchella* extends, consequently, from Florida in the northern hemisphere to 36° south latitude.

AMPHIOPUS (=AMPHIURA) ABDITA (Verrill).

Amphiura abdita VERRILL, Amer. Journ. Sci., vol. 2, 1871, p. 132.

Amphiura abdita LYMAN (75), pl. 5, fig. 82.

Amphiura abdita KÖHLER (07), p. 306, pl. 11, figs. 24-25.

Amphiura macilenta VERRILL, Amer. Journ. Sci., vol. 23, 1882, pp. 142 and 408.

Albatross station 2146. Apr. 2, 1884. Lat. 9° 32' N.; long. 79° 54' 30'' W.; 34 fathoms; brk. sh. One small specimen.

Albatross station 2242. Sept 26, 1884. Lat. 40° 15' 30'' N.; long. 70° 27' W.; 58 fathoms; gn. m.; temp. 51.4° F. Many specimens.

Albatross station 2317. Jan. 15, 1885. Lat. 24° 25' 45'' N.; long. 81° 46' 45'' W.; 75 fathoms; co.; temp. 75° F. One specimen.

Grampus, June, 1892. One specimen.

West coast of Florida. One specimen.

Key West, Florida. Four specimens.

No Name Key, Florida. Several specimens.

Cedar Keys, Florida. Three specimens.

The specimen from station 2317, the diameter of the disk of which does not reach 4 mm., is noticeable for its radial shields which are very small, rounded, or triangular, with rounded angles, about as long as wide; otherwise as in *abdita*.

Verrill considered it likely that *A. macilenta*, formerly described by him as a distinct species, was the young of *A. abdita*. After having examined two specimens determined by Verrill as *A. macilenta*, I agree with his conclusion.

AMPHIOPUS (=AMPHIURA) CUNEATA (Lyman).

Amphiura cuneata LYMAN (82).

Albatross station 2401. Mar. 14, 1885. Lat. 28° 38' 30'' N.; long. 85° 52' 30'' W.; 142 fathoms; gn. m. brk. sh. One specimen.

Family OPHIOMYCETIDÆ.

OPHIOMYCES MIRABILIS Lyman.

Plate 3, fig. 6.

Ophiomyces mirabilis LYMAN (69), p. 342.*Ophiomyces mirabilis* LJUNGMAN (71), p. 652.*Ophiomyces mirabilis* LYMAN (82), p. 242.*Ophiomyces mirabilis* LYMAN (83), p. 270.*Ophiomyces mirabilis* KOELLER (07), p. 316.

Albatross station 2644. Apr. 3, 1886. Lat. 25° 40' N.; long. 80° 00' W.; 193 fathoms; gy. s.; temp. 43.4° F. Two specimens.

Fish Hawk station 7286. Feb. 19, 1902. Lat. 24° 18' N.; long. 81° 47' 45'' W.; 133 fathoms; s.; temp. 53.5° F. One specimen.

Fish Hawk station 7296. Feb. 26, 1902. Lat. 24° 21' 25'' N.; long. 81° 47' 45'' W.; 122 fathoms; co.; temp. 54° F. Two specimens.

Lyman gave a very good description of *O. mirabilis* but he did not illustrate it. The example from station 2644 is of rather large size but the upper face is entirely missing; I was able to bring the arms down to the same level and to take a photograph of the under face which I reproduce here (pl. 3, fig. 6).

Family OPHIACANTHIDÆ.

The collection of Ophiurans which was sent me by the United States National Museum included a fairly large number of Ophiacanthidæ, some of which are new, while the others belong to species already known. Owing to the special difficulties which are experienced when making determinations in that family, I devoted myself not only to describing the former, but also, and with special attention, to the study of the known forms regarding which our knowledge is incomplete. Several species of the Ophiacanthidæ of the American coasts were named long ago by Verrill, but most of them were described by him in such a summary way that specialists agree that it is impossible to identify these species, the more so as they have not been illustrated. I have found in the collection of the National Museum a few of these species, and I have been able to obtain the cotypes of some others, but unfortunately I have been unable to borrow all the species which I should like to have studied. I have also examined with great benefit a few specimens determined by Lütken or by Ljungman which were most kindly lent me either by Professor Théel, of Stockholm, or by my friend Doctor Mortensen, of Copenhagen. Thanks to these various specimens, I have been able either to ascertain some doubtful determinations or to establish some comparisons, or again to complete, with full knowledge of the question, some insufficient descriptions. My researches would have been more complete had I been able to examine a few Atlantic forms such as *Ophiacantha cuspidata* Lyman, *segesta* Lyman, and *varispina* Verrill, the affinities of which I consider as being somewhat doubtful.

Before beginning with the description of the Ophiacanthidæ, I must admit that I feel somewhat puzzled, as will be understood by those who have studied the Ophiurans. The classification of the Ophiacanthidæ now represents an actual chaos, and the very limits of that family can not be indicated in a sufficiently precise

manner. We should be very thankful to Verrill for trying to establish a primary classification of these forms and to make in the genus *Ophiacantha* some eliminations which were necessary, owing to the steadily increasing number of the species attributed to the said genus. Unfortunately, the sections established by Verrill are most unequal; if some may be preserved, as having the value of genera, others hardly correspond to subgenera, or they are even very disputable and useless. That is why Hubert Lyman Clark, when he studied, in 1911, the North Pacific ophiurans in the collection of the National Museum, was impelled to write: "I am therefore reluctantly compelled to ignore Verrill's genera for the present and use *Ophiacantha* in a very wide sense."

In fact, Verrill did use, as a basis for the sections introduced by him, some characters which, at first sight, seem to have great value, but which practically offer a very disturbing lack of constancy and accuracy. More especially the respective size and the mode of arrangement of the oral or dental papillae, the shape of the adoral plates, and the presence or absence of a distal lobe, which enables the said adoral plates to separate the mouth shield from the first lateral brachial plate, the state of the spines which form at the basis of the arms and on each side some rows which dorsally are more or less approximate, the lesser or greater visibility of the upper plate of the disk, are, in fact, characters which essentially alter with age, and are sometimes found to vary in some specimens of the same size. I have already had occasion several times to call attention to their inconstancy, and I shall do so again farther on, when describing such species as *Ophiacantha anomala*, *O. bidentata*, *Ophiomitrella americana*, etc. But, on the contrary, I am of the opinion that the characters of the shape and armature of the tentacular pores, either oral or brachial, which may vary considerably in shape and be either deprived of or provided with scales having quite peculiar shapes and disposition, the presence of genuine granules which extend up to the oral plates, the flattening and widening of the brachial spines, etc., represent much more valuable structures; consequently some of the genera established by Verrill, such as *Ophiopora*, *Ophiolimna*, *Ophiopristis*, seem to me to be perfectly justified. I have myself based on some characters of the same sort such genera as *Ophiotrema*, *Ophiomedeia*, and *Ophiolela*. Verrill had also a very fortunate inspiration when he introduced some sections (*Ophiacanthella*, *Ophientrema*) for certain forms, as *Ophiacantha troscheli*, *tuberculosa*, *scolopendrica*, etc., or when he separated from the genus *Ophiomitra* the genus *Ophioplinthaca*. But how difficult it becomes to establish the limits of such genera as *Ophiotreta*, *Ophiotodia*, *Ophientodia*, *Ophioscalus*, etc. What is more, it is just as difficult to establish a limit between the genus *Ophiomitrella*, created by Verrill, and the genus *Ophiacantha*, in the restricted meaning he gives to the latter after having removed from it a whole series of forms, as it used to be to establish a limit between the genera *Ophiacantha* and *Ophiomitra*, when these two were taken in a much wider meaning. In fact, when one carefully examines several species which seem to be attributive to the genus *Ophiacantha*, one can not help acknowledging, the presence, in most cases, on the upper face of the disk of very distinct plates, if the teguments are somewhat thin, and especially if the specimen is dry. Is it right, then, because these plates are small, to classify this example as an *Ophiacantha*,

or, in case they are larger, as an *Ophiomitrella*? And which size will be taken as a standard for marking the limit? I mention this case because it seems to me to be one of the most delicate, and because the difficulty caused by it often arises with the Ophiacanthidae; should the characters given by Verrill to the genus *Ophiomitrella* be very rigorously applied, most of the *Ophiacanthæ* would finally pass over to that genus.

Therefore, I repeat that some of the genera proposed by Verrill are absolutely justified and very easy of application, and consequently are worthy of being preserved; but I must own that in most cases the generic determination of the Ophiacanthidae is extremely difficult. Without adopting the exclusive use of the expression *Ophiacantha* for all the cases, as has been done by H. L. Clark, I shall often adhere to that expression, putting between brackets the name of the section proposed by Verrill, in order to give some restriction to the rather extended meaning of the first name.

OPHIACANTHA ACULEATA Verrill.

Plate 11, figs. 1-2.

Ophiacantha aculeata VERRILL (85), p. 547.

Ophiacantha aculeata VERRILL (99), p. 36.

Ophiacantha aculeata VERRILL (99a), pp. 323 and 335.

Albatross station 2105. Nov. 6, 1883. Lat. $37^{\circ} 50' N.$; long. $73^{\circ} 03' 50'' W.$; 1,395 fathoms; glob. oz.; temp. $41^{\circ} F.$ Seven specimens.

I have been able to confirm my identification by comparison with a specimen determined by Verrill and coming from station 2725 (lat. $36^{\circ} 34' N.$; long. $73^{\circ} 48' W.$; 1,374 fathoms), and which was lent me by the National Museum. I beg to point out, on this subject, that *O. aculeata* was described by Verrill in 1885 from some specimens from stations 2034 (depth 1,346 fathoms) and 2105. The specimens which were sent me without a name come from the latter station.

In Verrill's cotype the diameter of the disk is 12.5 mm. Five out of seven specimens which I have studied have analogous dimensions, the diameter of the disk ranging between 12 and 14 mm.; two others are a little larger and their diameter reaches, respectively, 15 and 17 mm. The arms, which are generally incomplete, may be very long; in the specimen with the disk 15 mm. wide, one of the arms, which is entire, exceeds 90 mm., and Verrill states the length of the arms to be 110 mm.

Verrill's description is rather short and does not mention certain characters, such as the shape of the upper and under brachial plates, etc.; and as it is not accompanied by any drawings, I feel sure that it would not permit of identifying the species with certainty. I therefore think it best to describe the latter in a more complete manner and to reproduce at the same time a few photographs of the most characteristic specimens.

The outline of the disk is rounded. The convex upper face is covered with rather short stumps two or three times longer than wide, the surface of which is rough or even displays fine rugosities, and the end of which bears a few short and diverging spinules. These stumps, which are thick-set, all reach the same height; they are scattered uniformly over the surface of the disk and they completely hide the outline of the underlying plates; they also cover up the radial shields which are

invisible. Verrill has pointed out that these stumps were "smaller, longer, and more slender than in *O. bidentata*," with which he connects *O. aculeata*.

The under face of the disk, in the interradian spaces, is covered with stumps which are analogous to those of the upper face but shorter, a little thicker, less dense, and allowing the outlines of the plates to be seen; they extend as far as the mouth shields. The genital slits are elongated and narrow.

The mouth shields are rather small and much wider than long, triangular or lozenge-shaped, with an obtuse proximal angle limited by two straight sides which meet, by a rounded angle, the distal side, which is more or less convex; the latter is usually parted into two sides, united by a rounded and protruding angle. According to the more or less protruding character of this angle, the shield is either triangular or lozenge-shaped. The adoral plates are elongated, narrow, three or four times longer than wide, with almost parallel edges; they send outwardly a rather narrow blade which separates the mouth shield from the first lateral brachial plate. The oral plates are fairly large, high, and triangular. The oral papillæ, as a rule, are three on each side; the external one is flattened and very much widened, chiefly at its base, but it often has an end which is thinner and terminates in an obtuse point. Such is, at least, the arrangement which I observe on the example from station 2725 and which I also find on one of the specimens from station 2105, the diameter of the disk of which reaches 14 mm. On the others the arrangement of the oral papillæ remains regular at least on certain sides of the oral angles, but it is more or less altered on other sides. Verrill has pointed out that "sometimes an additional smaller one [oral papilla] stands out of line, behind those in the regular row." On the specimen from which I made my description (pl. 11, fig. 2), one of the oral plates carries a supplemental papilla, so that there are four in all on that side, the external one always keeping the usual widened form, and the other three being conical and equal; on another side I notice a little papilla which lies near the second normal one; the other eight sides present the usual arrangement. On two other examples there is on two sides a little supplemental papilla located between the most external and the preceding one. Finally, in others, one may find, instead of a single and odd dental papilla, two or three larger or smaller papillæ which, moreover, remain irregular in shape and number in the same specimen. In the largest specimen two dental papillæ are generally to be noticed, except on one of the jaws, and besides, sometimes there is a supplemental oral papilla on the sides, and therefore here is another example worth pointing out of the variations which the oral and dental papillæ of the Ophiacanthidæ may offer. I beg to call attention to these differences owing to the importance given by Verrill, when he classified the Ophiacanthidæ, to the arrangement of these papillæ; in fact if we strictly observed the diagnoses of the genera or subgenera which he established, certain specimens from station 2105 ought to be classified in the genus *Ophiacantha*, s. str., others in the genus *Ophientodia*, and a few might be placed indifferently in one genus or the other, according to which mouth angle one considers.

The arms are long, fairly wide, and not at all moniliform, although the lateral brachial plates are fairly protruding; they gradually get narrower up to their ends and the articles are short. The upper brachial plates are fairly large, triangular, with an acute proximal angle, and a wide and convex distal side; they are wider than

long. In the large specimens they are contiguous on the first brachial article, then are separated by an interval which is never very long except in the terminal part of the arms. On the specimens the disk of which ranges from 12 to 14 mm. in width, these plates may already be separated from the base of the arms by a narrow interval.

The first under brachial plate, which is rather small, is triangular with a convex distal side on the small specimens, and pentagonal on the larger ones; it has in the latter case two distal sides which meet in an obtuse angle, two straight lateral sides, and a rounded proximal side. The second plate is very large, triangular, almost twice wider than long, or even wider still; in the larger specimens the proximal angle is more or less opened, the distal side is very wide and convex; this second plate is already separated from the first one by the lateral plates. The succeeding plates are pentagonal with a most obtuse proximal angle, straight lateral sides, and a very convex distal side; they very rapidly grow narrower though remaining somewhat wider than long and the interspace between them becomes longer and longer. At a distance of 2 centimeters from the base of the arms this space is equal to the length of the said plates but exceeds it in the second half of the arms.

The lateral brachial plates are fairly protruding and each of them bears eight spines on the largest samples. These are elongated, rather thin, pointed, and their length increases from the first ventral one, which is longer than the article, to the penultimate dorsal one, which reaches two and a half articles, the last one being often rather smaller than the foregoing one. The surface of these spines may offer rugosities and even conical denticulations, always fairly short, which appear chiefly on the ventral and lateral spines and almost completely disappear on the dorsal ones, the surface of which has simply a rough appearance when seen through the microscope. The two lateral rows of spines always remain separated from each other at the base of the arms, and I do not notice that they are, as Verrill says, "forming an almost continuous band above." The spines become a little shorter and fewer toward the end of the arms, but the length of the dorsal ones remains always almost equal to two articles.

The tentacular scale is not very large, but it is a little widened at the base of the arms; it is conical and rather pointed on the smaller examples while it becomes obtuse at the end on the larger ones, and it is often slightly bent; it becomes a little thinner at a certain distance from the disk. Its surface is rough and there are even to be seen at its end a few small spinules on the smallest specimens.

The color of the specimens in alcohol is yellowish and the upper face of the disk is sometimes a little darker. Verrill says that the color of the live animal is light orange or buff.

Therefore, to sum up, *O. aculeata* shows the following main features: The size is large, since the diameter of the disk reaches 17 mm. in the largest known specimens; the said disk is rounded, not excavated in the interradial spaces, and it is covered by small stumps which are fairly elongated and spinulous. The oral papillæ number three on each side, the external one being always widened with the possible intercalation of a supplemental papilla; the number of tooth papillæ ranges from one to three. The upper brachial plates are large, triangular, fairly

approximated at the base of the arms; the under brachial plates are pentagonal, middle-sized, always a little wider than long. The brachial spines, amounting to seven or eight, are hardly echinulated, rather thin, elongated, and the length of the dorsal ones equals at least two and a half articles. The tentacular scale is middle-sized with a rather obtuse point in the largest specimens.

I shall refer again to *O. aculeata* a little further on when studying *O. fraterna* and *O. meridionalis*.

OPHIACANTHA ANOMALA Sars.

Plate 15, figs. 3-5.

Ophiacantha anomala G. O. Sars, Forh. Vidensk. Selsk., 1871, p. 12.

Ophiacantha anomala VERRILL, Amer. Journ. Sci., vol. 16, 1878, p. 214.

Ophiacantha anomala VERRILL, Check list Mar. Invert., 1879, p. 14.

Ophiacantha anomala LYMAN (82), pp. 179 and 198.

Ophiacantha anomala LYMAN (83), p. 260.

Ophiacantha anomala STORM, Kong. Norske Vidensk. Selsk., 1883, p. 10.

Ophiacantha anomala VERRILL (85), p. 547.

Ophiacantha anomala LUDWIG, Sitzb. Akad. Berlin, 1899, p. 21.

Ophiacantha anomala VERRILL (99), p. 36.

Ophiacantha anomala VERRILL (99a), pp. 324, 335, 339.

Ophiacantha anomala MORTENSEN (93), p. 86.

Ophiacantha anomala LUDWIG (94), p. 694.

Ophiacantha anomala MORTENSEN (10), p. 290.

? *Ophiacantha nodosa* LYMAN (82), p. 192, pl. 22, figs. 1-4.

Albatross station 2068. Sept. 1, 1883. Lat. $42^{\circ} 03' N.$; long. $65^{\circ} 48' 40'' W.$; 131 fathoms; s. fne. g., etc.; temp. $42^{\circ} F.$ Two specimens.

Albatross station 2663. May 4, 1886. Lat. $29^{\circ} 39' N.$; long. $79^{\circ} 49' W.$; 421 fathoms; br. s.; temp. $42.7^{\circ} F.$ One specimen.

Albatross station 2666. May 5, 1886. Lat. $30^{\circ} 47' 30'' N.$; long. $79^{\circ} 49' W.$; 270 fathoms; gy. s.; temp. $48.3^{\circ} F.$ Two specimens.

Albatross station 2668. May 5, 1886. Lat. $30^{\circ} 58' 30'' N.$; long. $79^{\circ} 38' 30'' W.$; 294 fathoms; gy. s. dd. co.; temp. $46.3^{\circ} F.$ Two specimens.

Albatross station 2669. May 5, 1886. Lat. $31^{\circ} 09' N.$; long. $73^{\circ} 33' 30'' W.$; 352 fathoms; gy. s. dd. co.; temp. $43.7^{\circ} F.$ One specimen.

Although *O. anomala* has often been cited by authors, for it has often been met with in the northern seas of Europe, and Verrill has reported it, as long ago as 1878, on the coasts of North America, it is after all little known, and I do not think anything has ever been added to the original, and by the way, excellent description which Sars published in 1871 and which was made from a specimen 11 mm. wide. But I observe, either on the specimens gathered by the *Albatross* in American seas, or on those coming from European seas which were lent to me or which are in my own collection, such variations as relate chiefly to the age of the examples and which it is important to note, the more so because some of these differences apply to the characters which Verrill referred to in order to classify the Ophiacanthidæ; it will consequently be of value to describe these specimens and to publish illustrations of some of them.

In the specimens which I have in hand, the diameter of the disk ranges between 12 and 5 mm.; all of them have six arms. The disk is hexagonal, generally a little excavated in the interradial spaces. In the younger specimens, the upper face

offers distinct plates, each of which carries a rather elongated little stump, which is thick, cylindrical, having a rough surface and its end terminated by a few elongated spinules which are rather thin and somewhat divergent. One may generally see ten protruding and more or less visible radial ribs at the end of each of which there is a little radial triangular shield, which is bare and separated from the one opposite by a rather narrow interval. On the larger specimens, the diameter of the disk of which ranges from 8 to 10 or 11 mm., the outlines of the upper plates become less discernible, though still distinct, and the little stumps which they carry are shorter and much stronger; the spinules at the ends of the said stumps are also fewer, shorter, thicker, unequal, and rather erect. The radial ribs are not always apparent, but one can easily see the very small radial shields, which are lying fairly close. In the largest specimen which I have studied (station 2668), the diameter of the disk of which reaches 12 mm., the little staves of the upper face of the disk appear in the form of thick, elongated granules with rough ends, which at first sight differ from those of the smaller specimens in which the diameter of the disk does not exceed 5 mm., but which are, nevertheless, connected with the latter through a set of intermediate forms.

Like arrangements are found again on the under face of the disk in the inter-radial spaces. The stumps of the plates extend up to the mouth shields and become progressively smaller and shorter, and at the same time, less rough and less spinulous.

The shape of the mouth shields varies with age. In the smaller specimens (plate 15, fig. 5), these shields are in the shape of triangles or lozenges, a little wider than long, with an obtuse proximal angle and a convex distal side, splitting sometimes into two sides united by a very plainly rounded angle. As the Ophuran is growing, the mouth shield becomes longer and it very soon grows to be longer than wide; it then appears fairly narrow and rather small, wider in its proximal part than in its distal region, with an exceedingly obtuse proximal angle which may even reach 180° , converging lateral sides and a very narrow and rounded distal side (fig. 4). This shape reminds one, as already pointed out by Sars, of that of the mouth shields of *O. spectabilis*. The adoral plates, which are middle-sized, are short, fairly broad, and have parallel sides. The oral plates are high and triangular. Sars, in his description, indicates four oral papillæ on each side. In fact, I never find more than three in the young ones; they are thin, very long, conical, pointed, and have about all the same shape although their thickness slightly increases from the external to the internal papilla. There is an odd dental papilla which is stronger than the neighboring papillæ, elongated and conical. In the adult, the number of oral papillæ is increased by the intercalation of two, or even three, supplementary papillæ, which break the regular arrangement of the first papillæ with which they are not in line; the result is that the oral papillæ show some variations in number and disposition. Generally speaking, the external papilla always remains somewhat wider than the others. Moreover, near the till then single dental papilla, are seen one or two other papillæ, so that the jaw is terminated with dental papillæ, the number of which varies from one to three. Consequently, the specimens which had first presented, by the arrangement of their oral and dental papillæ, the characters of the true *Ophiacantha* in the restricted

meaning adopted by Verrill, afterwards take on the characters of the genus *Ophientodia* of the same author.

The upper brachial plates are rather small, triangular, with a widely opened proximal angle and a strongly convex distal side; they are wider than long and separated by a fairly long interval.

The first under brachial plate is small, trapezoidal, narrower in its proximal than in its distal part, with diverging lateral sides. The second one is large, very much widened distally, with an obtuse proximal angle, diverging lateral sides, and a very convex distal side, which may sometimes present, in its middle, a very small and feebly protruding, widened median lobe. On the following plates the width slightly decreases and the distal side becomes more strongly convex; therefore, the plates become longer than wide, at the same time as the proximal angle becomes more open. This elongated form of the under brachial plates is quite striking, and in the young specimens these plates are seen to become sometimes even almost twice longer than wide. I usually notice, on the under face of the plate, within the distal side and parallel with it, two or three concentric striae, which are rather wide apart. The under plates always remain separated by a narrower interval in the adults than in the young.

The lateral plates bear on their somewhat swollen distal side seven or eight spines of increasing length from the first, which is almost equal to the article, to the last one, which may reach the length of two and a half articles. These spines are provided with fine and close denticulations in the young, which, however, are less apparent in the adult, where they nevertheless remain visible through the microscope.

The tentacular scale is fairly large and wide, somewhat lanceolate, with a very rough end. On the larger specimens this end is simply rounded, but on the two smallest specimens, the diameter of the disk of which does not exceed 5 mm., this scale is narrower and sharper, more so in one of them than in the other; in all the others the tentacular scale displays the form which I have just indicated. On the large specimens the tentacular brachial pores of the first pair always carry two scales.

Owing to the presence of distinct plates on the upper face of the disk, this species ought to be classified in the genus *Ophiomitrella*, if Verrill's classification be strictly adhered to. On the other hand, we have seen that the oral papillae are losing their regular arrangement with age; they may also become more numerous as the number of the dental papillae increases, such being the case in the species classified by Verrill in his genus *Ophientodia*.

When studying the descriptions and drawings of *Ophiacantha nodosa* published by Lyman, the question may be asked what are the characters on which that author has based the separation of that species from *O. anomala*. The most important difference which I find refers to the under brachial plates, which, according to Lyman, are a little wider than long, but it must be remembered that Lyman had at his disposal but one specimen, the arms of which were broken near the disk, and consequently he was unable to observe the changes in the form and elongation of the successive under brachial plates, so that it is very difficult to take this character into account. Therefore, the two species seem to me very likely to be synonyms.

However, it must be noted that *O. nodosa* comes from a depth (1,525 fathoms), where *O. anomala* has never been found.

O. anomala is known from the Arctic regions of Europe and on the coasts of North America; it has been found chiefly in the waters of Nova Scotia in about 100 to 130 fathoms. According to the indications of the stations which I have given above, it will be seen that the *Albatross* has taken *O. anomala* in more southern stations, between 42° and 31° north latitude. According to Lyman, *O. anomala* occurs in a depth of 524 fathoms, but the determination is doubtful.

OPHIACANTHA ASPERA Lyman.

See for bibliography:

Verrill (99), p. 44.

Köhler (97), p. 316.

Albatross station 2159. Apr. 30, 1884. Lat. 23° 10' 39'' N.; long. 82° 20' 08'' W.; 98 fathoms; co. Two specimens.

Albatross station 2166. May 1, 1884. Lat. 23° 10' 36'' N.; long. 82° 20' 30'' W.; 196 fathoms; co.; temp. 71.9° F. One specimen.

Albatross station 2167. May 1, 1884. Lat. 23° 10' 40'' N.; long. 82° 20' 30'' W.; 201 fathoms; co. Two specimens.

Albatross station 2335. Jan. 19, 1885. Lat. 23° 10' 39'' N.; long. 82° 20' 21'' W.; 204 fathoms. One specimen.

Albatross station 2342. Jan. 19, 1885. Lat. 23° 10' 39'' N.; long. 82° 20' 21'' W.; 201 fathoms; co. Two specimens.

Blake; 2 miles E. off Havana; 200 fathoms. Two specimens.

The diameter of the disk does not exceed 5 mm. in general; the arms are rarely preserved, except on one of the examples from Havana.

Lyman's description has been completed and rectified by Verrill, and the specimens are quite in accordance with those of the latter naturalist, as well as those I mentioned in 1907. The species is well characterized and easily to be detected.

O. aspera has been met with in various localities of the West Indies between 73 and 262 fathoms.

OPHIACANTHA BIDENTATA (Retzius).

Plate 8, figs. 3-4.

See for bibliography:

Köhler (99), p. 184.

Mortensen (10), p. 274.

Grieg (10), p. 5.

Köhler (13a), p. 14.

St. Augustine, Florida. No depth mentioned. One dry specimen.

The oral papillæ show the usual arrangement.

I have had quite recently occasion (13a, p. 14) to speak of the variations which the oral papillæ of *O. bidentata* may present in their number, as well as in their arrangement, when studying the specimens which Charcot had gathered in the northern regions of European seas. The examination of certain specimens of *O. bidentata* shows how difficult, and at the same time how dangerous, it is to establish

a classification among the Ophiacanthidæ, taking as a basis the characters of the mouth papillæ only. In a lot coming from one and the same locality one may find, beside such examples as have three oral papillæ, the last of which is widened, some others which have a regular row of four subequal papillæ and sometimes even five; this structure might be due to a splitting of the external papilla, as formerly suggested by Duncan and Sladen. But besides the three or four papillæ which form a regular row, there may also be seen either one or a variable number of papillæ, which are inserted on a different level from the others and are generally smaller than they are. These supplementary papillæ often appear at the junction of the oral and adoral plates, and they may vary in number from one to five; but they may also appear near the terminal tooth papilla, and thus constitute supplementary tooth papillæ which are almost as much developed as the normal papillæ. All these variations are observed on specimens of equal size; they appear to very variable degrees on the mouth angles of the same specimen, and they are absolutely not due to age. So that, according to which specimen is observed, nay, even according to which of the mouth angles of the same specimen is observed, one is likely to meet the characters which Verrill took as a basis either to maintain the genus *Ophiacantha*, s. str., or to establish new genera, such as those called by him *Ophiectodia* or *Ophientodia*, the value of which becomes consequently very doubtful.

One may see, by the illustrations which I reproduce here, and which represent the under face of the disk of two *O. bidentata* from Icelandic waters, how much the mouth papillæ may differ either by their number or by their arrangement from the type admitted as being normal (pl. 8, figs. 3 and 4).

OPHIACANTHA ECHINULATA Lyman.

Ophiacantha echinulata LYMAN (78a), p. 229, pl. 1, figs. 7-9.

Ophiacantha echinulata LYMAN (83), p. 262.

Ophioscalus echinulatus VERRILL (99), p. 39.

Ophioscalus echinulatus VERRILL (99a), pp. 327, 331, 336, and 333.

Ophiacantha pectinula VERRILL (99a), pp. 325, 338, 340, and 342.

Ophiacantha echinulata KÖHLER (07), p. 319.

Albatross station 2117. Jan. 27, 1884. Lat. 15° 24' 40'' N.; long. 63° 31' 30'' W.; 683 fathoms; yl. m. fne. s.; temp. 39.75° F. One specimen.

Albatross station 2629. Mar. 8, 1886. Lat. 16° 54' N.; long. 75° 10' 40'' W.; 1,169 fathoms; co. s.; temp. 38.4° F. One specimen.

Albatross station 2651. Nov. 28, 1887. Lat. 16° 54' N.; long. 63° 12' W.; 687 fathoms; wh. oz.; temp. 73.4° F. One specimen.

The two specimens from stations 2629 and 2651 are in good condition; the diameter of the disk ranges between 5.5 and 6 mm., and the arms are from 40 to 45 mm. long. The third specimen is somewhat larger, the diameter of the disk reaching 7 mm., but the arms are incomplete.

These specimens are not absolutely in agreement with the type which Lyman described and figured in 1878 from a single specimen, and especially they do not offer the bare widened radial shields which that writer indicated, but it must be noticed that, in the year 1883, after having studied many specimens gathered by the *Blake* in several stations of the West Indies, Lyman wrote (83, p. 262): "Some-

times the radial shields can not be seen, but are quite hidden by the short disk spines." Now, the Jardin des Plantes possesses one specimen of *O. echinulata*, from the dredgings of the *Blake* (the diameter of the disk reaches from 8 to 8.5 mm.), in which the upper face shows the same characters as those of the *Albatross* specimens which I have in hand, and the radial shields of which are small, separated, and more or less hidden by the spines. This specimen was most likely studied and determined by Lyman himself, and we have just seen that this writer admits some variations in the shape and armature of the radial shields. I shall add that, in their other characters, the specimens from the *Albatross* are altogether in conformity with that example from the *Blake*, and they undoubtedly belong to the same species, whichever name be given to the latter.

On the other hand, Verrill, in 1899, thought it advisable to create for *O. echinulata* the subgenus *Ophioscalus*, which he characterizes especially by the large bare widened radial shields remaining in contact almost on their whole length; these characters are borrowed from the description which Lyman had made in 1878 from his single example, but the correction made by that writer in 1883 is not taken into account. A little later on, but still in 1899 (99a, p. 342), Verrill created for an *Ophiacantha* which came from the dredgings of the *Blake* and which Lyman had sent to him under the name of *O. echinulata*, a new species, to which he gave the name of *O. pectinula* and which he classifies in his genus *Ophiectodia*, owing to the arrangement of the oral papillæ, to which I shall refer presently. Now, apart from the character of the oral papillæ, *O. pectinula* is astonishingly like an *O. echinulata* which is not provided with those widened radial shields which Lyman pointed out in 1878, but presents the shape indicated by him in 1883. However, in *O. pectinula* there are on the distal side of the upper brachial plates very thin, short, and pointed little spines, and this is undoubtedly the character which Verrill wanted to recall in the specific name chosen by him. Now, I find again these small marginal spines not only in the three examples from the National Museum, but also in the specimen coming from the dredgings of the *Blake* and kept at the Jardin des Plantes.

When describing *O. echinulata*, Lyman, who did not ascribe to the oral and tooth papillæ the same importance as Verrill afterwards gave them, says only that the papillæ amount to from 11 to 14 in each mouth angle, the external papillæ being larger, and that the end of each jaw bears one or two papillæ which are larger than the others. On the other hand, Verrill characterizes his genus *Ophiectodia* by the existence of extremely numerous oral papillæ which build a bunch or a double row on the level of the tentacular mouth pore; in his description of *O. pectinula* he begins by mentioning a first series of four or five papillæ which build a regular row, after which there appear on the level of the tentacular pore five or six distal papillæ. Now, I observe this arrangement in none of the specimens which I have in hand; in these the oral papillæ generally amount to five in all and form a regular row; they are elongated, conical, pointed, and the last two, which stand on the level of the tentacular mouth pore but are not separated from the preceding ones, are most generally either a little longer or a little wider than the others. As to the tooth papillæ, they vary in number and in size; they are sometimes two, sometimes three or four. But I repeat that I fail to find the slightest

trace of these special papillæ which should form a bunch or a double row so as to build for the mouth pore that particular covering indicated by Verrill.

I can not, therefore, give to my specimens the name of *Ophiotodia pectinula* and I retain for them the name of *Ophiacantha echinulata*. Besides, there can be no objection to that species being classified in the subgenus *Ophioscalus* of Verrill.

Thus *O. echinulata* remains well characterized by the peculiar covering of the upper face of the disk, which may hide, more or less completely, the radial shields, and the latter offer, in their shape and size, the variations indicated by Lyman. The species is also featured by the tentacular scale of the brachial pores, which is extremely long, narrow, very much pointed and rough, and almost as long as the corresponding under brachial plate; often, but not always, there are two scales on the first tentacular brachial pore; the under brachial plates, which are elongated, narrow, with a convex distal side, have also a rather characteristic shape.

Apart from the arrangement of the oral papillæ, the description given by Verrill of *O. pectinula* may, therefore, apply to the specimens which I have studied; but, on the other hand, I can not separate them from *O. echinulata*, for it is understood that as regards the shape of the radial shields such a restriction must be made as Lyman himself made in 1883. This being so, must *Ophiotodia pectinula* be considered as a synonym of *Ophiacantha echinulata*? Although this synonymy be very enticing, I do not think it ought to be admitted now, since Verrill has definitely taken the characters of the oral papillæ as a basis for the separation of the two species. The question will not be settled except by comparing a great many specimens; especially a revision of the specimens gathered by the *Blake* and indicated by Lyman in 1883 would be particularly interesting and is most desirable.

OPHIACANTHA ENOPLA Lyman.

Fish Hawk station 1124. Aug. 26, 1882. Lat. $40^{\circ} 01' N.$; long. $68^{\circ} 54' W.$; 640 fathoms; fine s., gn. m., limestone nodules; temp. $39^{\circ} F.$ One specimen.

OPHIACANTHA FRATERNA Verrill.

Plate 11, figs. 5-6.

See for bibliography:

Ophiacantha fraterna VERRILL (85), p. 545.

Ophiacantha fraterna VERRILL (99a), pp. 321, 324.

Albatross station 2105. Nov. 6, 1883. Lat. $37^{\circ} 50' N.$; long. $73^{\circ} 03' 50'' W.$; 1,395 fathoms; glob. oz.; temp. $41^{\circ} F.$ Nine specimens.

Albatross station 2678. May 6, 1886. Lat. $32^{\circ} 40' N.$; long. $76^{\circ} 40' 30'' W.$; 731 fathoms; lt. gy. oz.; temp. $38.7^{\circ} F.$ Three specimens.

In the larger specimens the diameter of the disk ranges between 8 and 9.5 mm.; in the smallest it does not exceed 3 mm. The largest examples are not in a very good state; the brachial spines are very incomplete, and the arms themselves are broken at a small distance from their base. In an example with a disk of 8 mm., the arms are from 40 to 45 mm. long.

I have been able to make sure of my determination by comparing these specimens with a specimen determined by Verrill and lent me by the U.S. National Museum,

and which came also from the dredgings of the *Albatross* (station 2573, southeast of Georges Bank, Sept. 2, 1885, 1,742 fathoms). This specimen is in a fairly good state although two arms are broken near the base and none of the other three are preserved to their entire length; the diameter of the disk equals 10 mm.

I shall avail myself of the opportunity offered me to study this species to add a few remarks to Verrill's description and especially to reproduce a few photographs of that form which has never been figured; it would be, in fact, very difficult to identify it only by the information given by Verrill.

I will first describe the example determined by the latter and afterwards I will compare with it the other examples which I have in hand.

The 10 radial ribs indicated by Verrill are plainly visible. The radial shields in which they end are quite distinct, though small; they are triangular, a little longer than wide, and bare or carry only a few little stumps near their periphery. The two shields of each pair are strongly set apart from each other and separated by an interval which is equal to the width of the corresponding arm. The upper face of the disk is covered with extremely thin, rounded, imbricated, and subequal plates, which become very apparent after they have been freed from the little stumps borne by them. These stumps really have the shape indicated by Verrill. I shall add that they are very short, very much widened at their base, and rather conical; the spinules which terminate them are rather thick, short, very irregularly arranged, and variable in number. Each plate bears only one such little stump.

The interradiar spaces of the under face of the disk are covered with larger and more distinct plates than on the upper face, and consequently the stumps are not so dense; they become shorter as they get nearer to the mouth shields. The genital slits are narrow, elongated, and quite distinct.

The mouth shields are short and strongly widened transversely; their shape is rather irregular on the specimen from Georges Bank, and the angles are more or less rounded; I observe no median lobe on the distal side. The adoral plates are narrow, elongated, and slightly incurved in the shape of a crescent; they preserve the same width over their whole length and do not separate the mouth shield from the first lateral brachial plate. The oral plates are of medium size. The oral papillæ, amounting to three on each side, display the characters indicated by Verrill; the external papilla, especially, is conical and pointed like the others, and even, perhaps, a little smaller than they are.

The arms are not moniliform. The upper brachial plates are large, triangular, almost as long as wide, or a little wider than long, with a fairly opened proximal angle limited by straight sides, and a very convex distal edge. On the first 10 or 12 articles the proximal angle is rather strongly truncated. These plates are at first contiguous, and afterwards separated by a little interval.

The first under brachial plate is small, trapezoidal, wider proximally than distally, with a small and rounded distal edge. The following plates are middle-sized, pentagonal, with a very obtuse proximal angle and a convex distal side; they are first much wider than long, and, at a certain distance from the disk, their width slightly decreases, though still remaining always wider than long. They are separated by a narrow interval from the base of the arms.

Verrill states that the tentacular scale is "flattened, small, tapered, subacute"; the form which I observe on my own specimen is a little different. Indeed, this scale, of middle size, appears flattened, elongated, fairly wide, and it always keeps the same width throughout its whole length, or even becomes a little wider in its distal part to end with a rounded edge; its surface is very rough.

All the specimens from stations 2105 and 2678 are smaller than the foregoing one, and display a few differences which are evidently due to their age. The radial ribs are distinct on only a few specimens, the diameter of the disk of which ranges between 5 and 8 mm.; in the two largest ones, the upper face of the disk displays corrugations which have very likely caused the relief of the ribs to disappear. The upper brachial plates are generally separated from the base of the arms. The under brachial plates are always wider than long at the base of the arms, but they afterwards become as wide as long, and they even become a little longer than wide at the ends of the arms. The mouth shields often have their side angles sharper than those of the specimen from station 2573, but they generally remain rounded; the oral papillæ preserve the usual arrangement. On the two larger specimens from station 2105, the tentacular scales of the first brachial articles are thinner and sharper than on the articles which succeed the disk, where they take the shape which I have reported above; but on the smaller samples, the form which I observe is nearer to the one indicated by Verrill, that is to say, the scales are thinner and subacute, sometimes a little lanceolate, but always fairly long.

Verrill connected *O. fraterna* with *O. bidentata*, the latter offering certainly a great analogy with the former. It will, however, always be possible to distinguish the first from the second species; by the form of the external oral papilla which is not widened and offers the same shape as the other two in *O. fraterna*, where it is elongated, cylindrical, and almost spiniform; by the brachial spines being rougher; by the small stumps of the upper face of the disk being thinner and ending in a bunch of notably stronger spinules. The mouth shields and the adoral plates have almost the same shape in both species.

But it is not to *O. bidentata* that *O. fraterna* is most closely allied; it is undoubtedly nearer *O. aculeata* Verrill, and the comparison with the latter is all the more necessary because I have found both species in the lot of Ophiurans which came from station 2105. All the *O. fraterna* of that lot being smaller than the *O. aculeata*, the question might be asked whether the former were not simply the young of the second species. Above all, the shape of the external oral papilla will always allow *O. fraterna* to be distinguished from *O. aculeata*. In fact, in all the *O. fraterna* observed by me, in which the diameter of the disk varies from 3 to 9.5 mm., this papilla always remains identical with the other two, and although I have observed no specimen of *O. aculeata* less than 12 mm. in diameter, it is not admissible that the shape of that papilla begins to alter only when the disk of the Ophiuran has reached a diameter superior to 9 mm., and that it only then takes the strikingly widened shape which it displays in *O. aculeata*, the diameter of which is 12 mm. or more. If we compare some specimens of *O. fraterna*, such as the one from Georges Bank, the disk of which is 10 mm., with some *O. aculeata*, such as the one represented on plate 11, figures 1 and 2, the diameter of the disk of which is about

15 mm., we shall find the following differences: The radial shields which are distinct, though small, in *O. fraterna*, are altogether indistinct in *O. aculeata* where they are covered over with stumps identical with those existing on the rest of the upper face of the disk, and radial ribs never appear in the latter. The mouth shields have about the same shape in both species, but the adoral plates do not separate the mouth shield from the first lateral brachial plate in *O. fraterna*, while they do separate it in *O. aculeata*. The upper brachial plates are smaller, contiguous from the base of the arms in the largest samples of the first species, while they are larger, widened, and separated from the base in the second one. The upper brachial plates always remain very wide and wider than long in *O. fraterna*, while in *O. aculeata* their width rapidly decreases and they become as long as wide, and then longer than wide. The brachial spines are a little rougher in *O. fraterna* and the tentacular scale is a little more widened than in *O. aculeata*.

I shall discuss a little further the affinities of *O. fraterna* with *O. pentacrinus*, after having described the latter species.

OPHIACANTHA GRANULIFERA Verrill.

Plate 10, figs. 2-3.

Ophiacantha granulifera VERRILL (85), p. 546.

Ophiacantha granulifera VERRILL (99a), pp. 321 and 324.

Albatross station 2069. Sept. 1, 1883. Lat. 41° 54' 50'' N.; long. 65° 48' 35'' W.; Georges Bank; 101 fathoms; s. st. g. p. and c.; temp. 42° F. One specimen.

The specimen which has been lent me was determined by Verrill. As his description, although sufficient to allow the species to be identified, is rather short and not accompanied with any drawings, it has seemed to me useful to give a few notes on the specimen in hand and to reproduce two photographs of it.

The diameter of the disk is 10 mm.; the arms are not complete; they are broken at 40 mm. from their bases and must have reached about 50 mm. The disk is rounded, excavated in the interrational spaces. The upper face is uniformly covered with little rounded granules, which are very dense although not absolutely contiguous, and have a rough surface; these granules are most regularly arranged and all of them have the same diameter. They almost completely hide the limits of the plates which carry them; however, the latter appear very distinctly, in my specimen, at the periphery of the disk and on each side of the radial shields; these plates are fairly large, somewhat unequal and imbricated. The radial shields are visible on their whole length; they are narrow and elongated, triangular, three or four times longer than wide and completely bare; the two shields of each pair are widely separated from each other by several rows of plates. The under face is completely deprived of granules and covered with fairly large, unequal, and imbricated plates. The genital slits are narrow and elongated.

The rather small mouth shields are very wide and include a chief part, which is triangular, short, three times wider than long, with a very obtuse proximal angle and rounded lateral angles; the distal side, which is convex, offers in its middle a widened and very much elongated lobe, the length of which reaches that of the chief part of the plate; this lobe strongly protrudes into the interrational space, and

its distal side is rounded. The adoral plates are well developed, fairly large, very much widened inwardly and narrower outwardly. The oral plates, which are triangular, are rather small. All these plates are covered with fine granulations. The oral papillæ amount to three or four on each side; they are rather strong and conical and their end is sometimes pointed, sometimes blunt. The dental papilla, which is single and odd, is larger than the neighboring oval papillæ.

The upper brachial plates of middling size are triangular, with a fairly open proximal angle, and slightly corrugated diverging lateral sides, and a wide and convex distal side. These plates are almost as wide as long, and they are separated from the bases of the arms by a fairly narrow interval.

The under brachial plates are remarkably short and wide, as pointed out by Verrill, and they are broadly separated by the lateral plates. The first one is wider than long, quadrangular, with a rounded and convex distal side, a concave proximal side, and two diverging lateral sides. The following ones are extremely wide, at least four times wider than long and triangular, with a very obtuse proximal angle limited by narrow sides, which meet the distal edge by fairly acute angles; the said distal edge is extremely wide and often excavated in its middle. At a certain distance from the disk the plates become narrower and comparatively a little longer; they are then pentagonal, with two diverging lateral sides, which are excavated by the corresponding tentacular scale, and a convex distal side.

The lateral plates carry eight or nine spines. The ventral spines are rather thick and obtuse at their ends. The length of the first one exceeds the article, and increases on the following spines up to the last dorsal ones, which are equal to two and a half or three articles; these are pointed and comparatively thinner than the ventral spines. The surface of all these spines is rough or even covered with small, conical, and pointed asperities, which are put very close together. The two lateral rows of spines are not approximated dorsally.

The tentacular scale, which is always single, is small and short, conical or lanceolated; its surface is rough or it is even provided on its sides and at its end with extremely small spinules.

OPHIACANTHA LINEATA Kehler.

Ophiacantha lineata KEHLER (09), p. 187, pl. 25, figs. 6-8.

Albatross station 2415. Apr. 1, 1885. Lat. $30^{\circ} 44' N.$; long. $79^{\circ} 26' W.$; 440 fathoms; co. ers. s. sh. for.; temp. $45.6^{\circ} F.$ One specimen.

Albatross station 2667. May 5, 1886. Lat. $30^{\circ} 53' N.$; long. $79^{\circ} 42' 30'' W.$; 273 fathoms; gy. s. bk. sp.; temp. $48.7^{\circ} F.$ One specimen.

Both specimens are small and the diameter of the disk does not exceed 5 mm.; moreover, they are in a very bad state, the arms are broken at their base or preserved only for a very short length; besides, some rubbing has taken place, which caused almost all the stumps of the upper face of the disk to be torn. Nevertheless, I found again the characters which I originally ascribed to *O. lineata*, and I think the specimens may be referred to that species.

A very young example, the diameter of the disk of which did not exceed 2 mm., is associated with that from station 2415, and undoubtedly also belongs to *O. lineata*.

OPHIACANTHA PENTACRINUS Lütken.

Plate 9, figs. 3-6.

See for bibliography:

- Ophiacantha pentacrinus* LÜTKEN (69), pp. 46 and 99.
 not *Ophiacantha meridionalis* LYMAN (69), p. 324.
 not *Ophiacantha pentacrinus* KÉHLER (07), p. 319.
 part? *Ophiacantha pentacrinus* LYMAN (78), p. 280.
 part? *Ophiacantha pentacrinus* LYMAN (82), p. 199.
 ?*Ophiacantha pentacrinus* VERRILL (99a), pp. 324 and 334.

Blake station 222. Feb. 16, 1879. Lat. $13^{\circ} 58' 37''$ N.; long. $61^{\circ} 04' 45''$ W.
 422 fathoms; s. oz.; temp. 42.5° F. One specimen.

Albatross station 2117. Jan. 27, 1884. Lat. $15^{\circ} 24' 40''$ N.; long. $63^{\circ} 31' 30''$ W.; 683 fathoms; yl. m. fne. s.; temp. 39.75° F. One small specimen.

Albatross station 2664. May 4, 1886. Lat. $29^{\circ} 41'$ N.; long. $79^{\circ} 55'$ W.; 373 fathoms; co. s.; temp. 42.7° F. Five specimens.

Albatross station 2667. May 5, 1886. Lat. $30^{\circ} 53'$ N.; long. $79^{\circ} 42' 30''$ W.; 273 fathoms; gy. s. bk. sp.; temp. 48.7° F. Two specimens.

Albatross station 2753. Dec. 4, 1887. Lat. $13^{\circ} 34'$ N.; long. $61^{\circ} 03'$ W.; 281 fathoms; bk. s.; temp. 48° F. One specimen.

Unfortunately, the specimens are not in a very good state of preservation; in nearly all of them the arms are incomplete, and in the four largest ones from station 2664 the upper face of the disk is more or less damaged. In the latter specimens the diameter reaches from 5 to 5.5 mm.; in the others it varies between 3 and 4.5 mm.

In my work on the Ophiurans of the Paris Museum (07, p. 319), I published, concerning *O. pentacrinus*, a few remarks and two drawings, one of which represents the under face of the disk and the other a few stumps of the upper face, after the three specimens which were gathered by the *Blake* and presented to the Jardin des Plantes by Agassiz under the name of *O. pentacrinus*. I beg to recall on the subject, that Lyman, after having described under the name of *O. meridionalis* an *Ophiacantha* found in the Caribbean Sea between 237 and 327 fathoms (69, p. 324), had suggested that this species probably did not differ from *O. pentacrinus* Lütken, and he had definitely united it to the latter in his subsequent publications. Now, I have been able to examine the very type of *O. pentacrinus* described by Lütken, and preserved in the Copenhagen Museum; although this specimen, which is unique, is of very small size, since the diameter of the disk hardly reaches 3 mm., and although its arms are broken near their bases, its characters are, nevertheless, very plain. I have been most astonished to find that the three specimens of the Jardin des Plantes which are called *O. pentacrinus* are entirely different from it. On the contrary, I have noticed that all the specimens gathered by the *Albatross* at the three above-named stations were in perfect conformity with the type. The comparison was, besides, made easier by the presence, among the above-mentioned specimens of the *Albatross*, of two very small examples, which measure only 3 mm. across the disk and which have, consequently, dimensions identical with those of Lütken's type. There can exist no doubt as to the determination of these specimens.

As we have about *O. pentacrinus* only the description written in Danish by Lütken, of a very young specimen, unaccompanied with any figure, it will be useful to again describe the species from the *Albatross* specimens, supplementing the description with illustrations.

The disk is rather thick; its outline is pentagonal and it is strongly excavated in the interradial spaces. The upper face is covered with dense, very short and thin stumps, which are thicker at their bases and terminated by a few very thin and divergent spinules; the latter are equal and often amount to three. These stumps almost completely hide the outlines of the plates from which they start and which are very small. The radial shields are elongated and they generally cause a fairly visible swelling, but their external region alone is apparent and they are covered with stumps identical with the others over one-half or two-thirds of their length. The two shields of each pair are widely separated.

The under face of the disk offers, in the interradial spaces, some plates which are larger than on the upper face, chiefly near the mouth shields, and with very distinct outlines; these plates bear stumps which rapidly become smaller than on the upper face and are reduced to the state of small, rough, and elongated granules before they reach the mouth shields.

The latter are small, twice wider than long, triangular, with an acute proximal angle limited by two concave sides and lateral angles now sharp, now slightly rounded; the convex distal side sometimes offers at its middle a short and widened little lobe, more or less apparent. The rather thick adoral plates are bent in the shape of a crescent, and thinner near their external end, which does not separate the mouth shield from the first lateral brachial plate. The oral plates, of middle size, are triangular. The oral papillæ, amounting to three, are conical and pointed, and all have the same shape; the external one is sometimes a little more obtuse than the others at its end, but it is neither flattened nor widened. The single tooth papilla is thicker than the neighboring ones. There is sometimes a fourth supplementary oral papilla. Moreover, I observe that sometimes the first under brachial plate carries, on each side, a little papilla smaller than the others and advancing toward the tentacular mouth pore; this papilla is, moreover, often ill-shaped, or even completely lacking.

The arms are very moniliform owing to the enormous swelling which the lateral brachial plates offer in their distal region; the middle part of the articles is, on the contrary, very much narrowed. The upper brachial plates, which are middle-sized, are triangular with an acute proximal angle and a distal side which is almost straight on the first articles and afterwards becomes more and more convex; at first they are wider than long and then they become almost as long as wide. These plates strongly bulge out on their dorsal face and are separated by a very wide space, which is almost as long as the plates themselves on the large specimens and becomes still longer on the small ones. Sometimes the distal side is resolved into two short sides which can even be slightly concave and join by an obtuse angle.

The first under brachial plate is sometimes trapezoidal, longer than wide, and narrow, with the proximal side wider than the distal side, which is rounded and has converging lateral sides, sometimes simply triangular with a rounded distal apex.

The second plate, which is already separated from the preceding one by the lateral plates, is very large, triangular, with a proximal angle limited by two almost straight sides, and a strongly convex distal side; it always remains wider than long. The proximal angle becomes more and more obtuse on the following plates, which are pentagonal, with two small lateral sides and a distal side which is always strongly convex. All these plates always remain fairly large, wider than long, and the space which separates them is larger as the examples are smaller. I have found in Lütken's type the confirmation of the fact that the under brachial plates, however small they may be, always remain wider than long.

The lateral brachial plates bear on the whole length of their distal side, which is thickened and widened, at least seven spines on the first articles and sometimes eight in the largest specimens. The first three spines are not very large; they are almost equal and the third one reaches about the length of the article. These three spines are rather thick, cylindrical, with an obtuse end, and they show extremely fine and dense denticulations. Afterwards the length of the spines rapidly increases and the two or three last dorsal ones become extremely long, slender, pointed, transparent, with stronger and widely spaced denticulations, the number and size of which varies greatly. The length of the dorsal spines exceeds three articles at the bases of the arms, then it progressively decreases and finally does not exceed the article in the second half of the arm. The number of spines decreases beyond the first articles and remains five in number on the larger part of the length of the arms. On the first articles, the two rows are very approximate dorsally.

The tentacular scale is small, spiniform, pointed, rough, or even provided with small asperities.

O. pentacrinus does not seem to acquire great dimensions and the diameter of the disk ranges between 3 and 5.5 mm.

O. pentacrinus has undoubtedly been mistaken by Lyman for another species in which the oral papilla is wide and flattened, a character which *O. pentacrinus* does not show in Lütken's type. It is likely that the specimens gathered by the Blake and referred to by Lyman in 1883 under the name of *O. meridionalis* Lyman = *O. pentacrinus* Lütken, included a mixture of the two forms; these specimens ought to be sorted out. In any case, Lyman designated under the name of *O. pentacrinus*, a term which according to him was the synonym of *O. meridionalis*, some specimens which had their external oral papilla widened and flattened, since three specimens from the Blake which certainly have been determined by him, were sent to the Jardin des Plantes under the name of *O. pentacrinus*. Consequently, if after making the comparison with Lütken's type, we keep the name of *O. pentacrinus* for an *Ophiacantha* the external oral papilla of which is not widened but preserves the same shape as the other two, we may give the name of *O. meridionalis* to the neighboring species which Lyman had confused with it and in which the said papilla is widened and flattened. Now, I find among the Ophiurans gathered by the Albatross some specimens which offer precisely the same character, and I shall describe them further under the name of *O. meridionalis*.

The characters of *O. pentacrinus* do not seem to me to have been better distinguished by Verrill; what is more, I notice a contradiction in the two passages

of his paper on the Ophiurans of North America which he published in 1899. In fact, he writes (99a, p. 324), "arm spines, six upper ones very slender," and a little further on (p. 334), "spines nine or ten long very slender," etc.

One can see that the examination of Lütken's type was a necessity, and, as I was fortunate enough to be able to make it, I hope that the characters of *O. pentacrinus* are now fixed.

I have pointed out above that all the specimens of *O. pentacrinus* were of rather small size, and it might perhaps be thought that they represent only the young form of another *Ophiacantha*. Now, among the forms of the Atlantic with which they might be compared I see none which may be cited, except *O. fraterna*, which shows a likeness in the arrangement of the three oral papillæ which remain equal and subacute. But *O. pentacrinus* is plainly distinct from the latter through its moniliform arms offering elongated articles and brachial spines which on the upper side become very long, thin, pointed, transparent, denticulated, with the rows closely approximated on the first articles. The upper brachial plates are strongly bulging out and widely separated, as are also the under plates. None of these characters exists in *O. fraterna*.

I approximate to *O. pentacrinus*, without daring, however, actually to refer them to this species, three very small specimens from station 2117 (plate 9, figs. 5, 6), which bear No. 12495. The diameter of the disk does not exceed 3 mm. and the arms are slender and moniliform. The brachial spines and the covering of the upper face of the disk show the same characters as in *O. pentacrinus*, but there are four oral papillæ, the external one being inserted on the first under brachial plate; the upper brachial plates are very small and separated by a very large space, and lastly the under brachial plates, which at first were broad, become rapidly longer than wide. These plates reach their maximum length between the sixth and the tenth plates, then the length progressively decreases. I beg to represent here a specimen in which the under plates display the maximum relative length.

I do not see to what other species this *Ophiacantha* might be approximated; I dare not make a new species of it, owing to the small size of the examples which are probably young ones.

OPHIACANTHA MERIDIONALIS Lyman.

Plate 9, figs. 1-2.

Ophiacantha meridionalis LYMAN (69), p. 324.

part? *Ophiacantha pentacrinus* LYMAN (78), p. 280.

part? *Ophiacantha pentacrinus* LYMAN (82), p. 199.

Ophiacantha pentacrinus KÖHLER (07), p. 319.

Blake station 222. Feb. 16, 1879. Lat. 13° 58' 37'' N.; long. 61° 04' 45'' W.; 422 fathoms; s. oz.; temp. 42.5° F.

Albatross station 2655. May 2, 1886. Lat. 27° 22' N.; long. 78° 07' 30'' W.; 338 fathoms; gy. s.; temp. 47.5° F. One specimen.

Albatross station 2664. May 4, 1886. Lat. 29° 41' N.; long. 79° 55' W.; 373 fathoms; co. s.; temp. 42.7° F. A few specimens.

In most samples from station 2664, the diameter of the disk varies between 5 and 6.5 mm., and in that of station 2655 it reaches 7 mm. Almost all the specimens have their arms broken, and the length of such as remain whole varies between 30 and 35 mm.

I have been able to ascertain that these specimens are in perfect conformity with the three samples from the dredgings of the *Blake*, which I mentioned when describing *O. pentacrinus* and which were given by Agassiz to the Jardin des Plantes under the name of *O. pentacrinus*. These three specimens were evidently determined by Lyman, who had in hand the Ophiurans from the *Blake*; they are a little smaller than the specimens from the *Albatross*, the diameter of the disk ranging from 2.8 to 4 mm. All three have their external oral papilla flattened and widened, and the name of *O. pentacrinus* can not be applied to them, as I have explained above. I therefore suggest reserving for these individuals the name of *O. meridionalis*, a denomination which has undoubtedly been applied by Lyman to a certain number of similar specimens. In order to clear up any confusion, I think I had better give of that species a somewhat detailed description, and two photographs which reproduce respectively the dorsal and the ventral faces.

The disk is rounded, not at all excavated in the interradial spaces; it is rather thick and the upper face is more or less bulging. But this face is completely covered by small, very dense, elongated and fairly thin spines which display on their surfaces a few more or less developed asperities or irregular denticulations, and are terminated by a few rather scarce and unequal spinules which amount to two or three only. These little spines completely hide the outlines of the adjacent plates. Sometimes there are seen radial ribs which are little protruding, but the radial shields themselves are partly covered by stumps and their distal part alone is visible; they are widely separated.

On the under face of the disk, the small spines become less and less important, as they come nearer to the mouth shields, and they are finally reduced to the state of mere conical, rough granules; the underlying plates then become apparent; they are very small, rounded, and more or less imbricated. The genital slits are elongated and broad.

The mouth shields, which are of middle size, have a shape analogous to that of *O. pentacrinus*, that is to say, they are triangular, much wider than long, with an obtuse proximal angle limited by two straight sides, rounded lateral angles and a convex distal side which often shows in its middle a little lobe, which, by the way, is very variable in size. The adoral plates are elongated, fairly narrow, with parallel sides which are almost straight; they are from three to three and a half times longer than wide, inwardly contiguous, and they outwardly build, although without growing wider, a more or less conspicuous blade which separates the mouth shield from the first lateral brachial plate. The oral plates are fairly high and triangular. The oral papillæ number three on each side; the external one is widened, flattened, and squamiform, without, however, offering an excessive development, and the other two are conical and pointed. The dental papilla, which is single, is strong and conical.

The arms are moniliform, less so, however, than in *O. pentacrinus*. The shape of the upper brachial plates very much recalls that observed in this latter species;

they are, though, a little less bulging, and they become a little longer than wide. They are always separated by a fairly long space which, however, remains inferior to their length.

The first under brachial plate is trapezoidal, wider than long, with a wide and convex proximal side, a smaller and rounded distal side toward which converge the lateral sides, which are small and straight; it is separated from the second one by the lateral plates, but sometimes, however, the proximal angle of the former gets elongated so as to reach the distal edge of the first plate. The second ventral plate is generally triangular with a still obtuse proximal angle which is limited by two almost straight sides and a very wide and convex distal side; sometimes, however, it is already pentagonal with two small lateral sides; it is always wider than long. The succeeding plates become pentagonal with an obtuse proximal angle, short lateral sides and a rounded distal side; they always remain much wider than long. The space which separates these plates becomes longer and longer until it finally reaches twice their length; in fact, from the middle of the arms, these plates become very short and, besides, comparatively small, although they always remain wider than long. The lateral plates are fairly widened in their distal part, but they are, however, less thick than in *O. pentacrinus*. They carry seven and even eight spines on the first articles. These spines recall those of *O. pentacrinus*; however, the ventral spines are thinner at the ends and their denticulations are stronger and more loosely arranged; besides, their length increases in a more regular manner from the first ventral spine, which is almost equal to the article, to the dorsal spines, the last two or three of which reach about the length of three articles. These spines show denticulations which lie rather loosely, are thin and pointed, a little more numerous on the ventral than on the dorsal spines; the rows are very much approximated dorsally. The length of the dorsal spines progressively decreases from the bases of the arms upward, and their length finally equals one and a half articles at the same time as the number of the spines decreases.

The tentacular scale, rather small, is spiniform, pointed and fairly rough.

Connections and differences.—*O. meridionalis* is evidently very closely allied to *O. pentacrinus*; the latter species, as I have stated above, corresponds to Lyman's type, but it is at once distinguishable from it through the widened and flattened external oral papilla, which creates a difference which alone is sufficient to separate the two species. There are, besides, other distinctive characters. In all the samples of *O. meridionalis* which I know the disk is rounded, not excavated in the interradial spaces, while in all the specimens of *O. pentacrinus* from the *Albatross*, as well as in Lyman's type, these spaces are not only excavated but they are deeply notched. The upper face of the disk is covered with real little spines, which are slender and show on their surface some rugosities or denticulations and are ended by short spinules, while in *O. pentacrinus* there are short stumps ending in three elongated and diverging spinules. The first three brachial spines are more pointed and their length increases more progressively than in *O. meridionalis*; lastly, the adoral plates are elongated, not very thick, with almost straight and parallel sides in *O. meridionalis*, and they separate the mouth shield from the first lateral brachial plate, while in *O. pentacrinus* they are thicker, grow outwardly thinner and do not exceed the mouth shield.

These two species do not seem likely to reach a large size, and the diameter of the disk does not exceed 6 mm. in the examples which I know.

The question might be asked, as it has been for *O. pentacrinus*, whether *O. meridionalis* may not be a young form of a large species, for instance, *O. aculeata*, because *O. meridionalis* has, like the latter, the external oral papilla widened; but the above hypothesis can not be upheld. For in *O. meridionalis* the upper face of the disk is provided with small spines instead of the short stumps which appear in *O. aculeata*; the arms are moniliform, the lateral brachial plates, strongly protruding and swollen in their distal part, carry spines which become very long and thin on the dorsal side, a character which is lacking in *O. aculeata*. Neither can *O. meridionalis* be mistaken for a young specimen of *O. bidentata*.

O. composita K  hler, which is met with in the Atlantic Ocean, also recalls *O. meridionalis* by its widened external oral papilla, but differs from it by the upper face of the disk being covered with short stumps and ending in a crown of numerous thin and short spinules which are generally arranged in a regular manner, by its nonmoniliform arms which offer comparatively small dorsal plates which are as long as wide, completely flat and without any trace of bulging; by its under brachial plates which are remarkably widened, and lastly by its brachial spines which always remain shorter, dorsally, than in *O. meridionalis*.

OPHIACANTHA VEPRATICA Lyman.

Plate 13, fig. 6.

Ophiacantha vepratice LYMAN (78), p. 137, pl. 10, figs. 245-247.

Ophiacantha vepratice LYMAN (82), p. 182, pl. 13, figs. 7-9.

Ophiacantha vepratice LYMAN (83), p. 261.

Albatross station 2415. Apr. 1, 1885. Lat. 30° 44' N.; long. 79° 26' W.; 440 fathoms; co. crs. s. sh. for.; temp. 45.6° F. Numerous specimens.

Albatross station 2416. Apr. 1, 1885. Lat. 31° 26' N.; long. 79° 07' W.; 276 fathoms; co. brk. sh.; temp. 53.8° F. Two specimens.

Albatross station 2625. Oct. 21, 1885. Lat. 32° 35' N.; long. 77° 30' W.; 247 fathoms; gy. s. bk. sp. Several specimens.

Albatross station 2661. May 4, 1886. Lat. 29° 16' 30'' N.; long. 79° 36' 30'' W.; 438 fathoms; gy. s. bk. sp.; temp. 45.5° F. Several specimens.

Albatross station 2663. May 4, 1886. Lat. 29° 39' N.; long. 79° 49' W.; 421 fathoms; br. s.; temp. 42.7° F. Several specimens.

Albatross station 2666. May 5, 1886. Lat. 30° 47' 30'' N.; long. 79° 49' W.; 270 fathoms; gy. s.; temp. 48.3° F. Three specimens.

Albatross station 2667. May 5, 1886. Lat. 30° 53' N.; long. 79° 42' 30'' W.; 273 fathoms; gy. s. bk. sp.; temp. 48.7° F. One specimen.

Albatross station 2668. May 5, 1886. Lat. 30° 58' 30'' N.; long. 79° 38' 30'' W.; 294 fathoms; gy. s. dd. co.; temp. 46.3° F. Several specimens.

Albatross station 2669. May 5, 1886. Lat. 31° 09' N.; long. 79° 33' 30'' W.; 352 fathoms; gy. s. dd. co.; temp. 43.7° F. Six specimens.

Albatross station 2753. Dec. 4, 1887. Lat. 13° 34' N.; long. 61° 03' W.; 281 fathoms; bk. s.; temp. 48° F. Several specimens.

The study of the many specimens gathered by the *Albatross* enables me to complete Lyman's description or perhaps to correct it on some points.

O. vepratrica was established by him for four specimens, two of which are young ones; in the type, the diameter of the disk measured 6.5 mm.; the specimens from the *Albatross* are generally a little larger and the diameters of their disks usually range between 7 and 8 mm.

Lyman characterized *O. vepratrica*, among other things, by the presence on the upper face of the disk of granules with which a few short spines were mixed, and these spines were represented by him on various drawings (78, pl. 10, fig. 246, and 82, pl. 13, fig. 8); now, among the many hundreds of specimens which I have been able to examine, I have not found a single one bearing spines on the upper face of the disk. In all of them the disk offers an extremely regular covering of granules which are somewhat irregular in thickness, but all of which reach the same height; these granules are large and elongated and their shape is that of an extremely short cylinder, ending in a small swollen head; this head is covered with extremely small, short, pointed, and dense spinules, which are hardly visible except through the microscope. The radial shields are small, in the shape of very much elongated and narrow triangles, widely separated. All these details can be ascertained on dry specimens only, on which may easily be seen the limits of the upper plates of the disk, these plates carrying each a very short cylindrical stump.

The upper face of the disk thus shows some characters and an appearance which are fairly different from what Lyman pointed out, and I should never have been so daring as to refer my specimens to *O. vepratrica* had not the Jardin des Plantes possessed a specimen of that species from the dredgings of the *Blake* and determined by Lyman, the examination of which enabled me to fix my own determination. This example, though very small, since the diameter of his disk is only 4 mm., is altogether in conformity with the specimens from the *Albatross*; especially is the upper face completely deprived of spines and bears only some elongated granules which are very rough, ending in very conspicuous spinules, which are absolutely identical with those observed by me on my own specimens.

The mouth pieces are disposed as indicated by Lyman. The under brachial plates are very large and wide; they are first wider than long and then they become as long as wide; a few concentric striæ are seen on their surface as well as on that of the lateral plates. The tentacular scale is large and fairly wide, somewhat rough; there are sometimes two such scales on the tentacular pores of the first pair, and in this case the external scale is smaller than the internal one. The spines amount to eight at the base of the arms; Lyman indicates only seven of them in his description, but on his drawing (82, pl. 13, fig. 9) he reproduced eight; these spines seem to be smooth when seen with the naked eye, but through the microscope they appear covered with numerous denticulations which are exceedingly small, pointed, short, and dense. The two rows of spines are more approximated dorsally than represented by Lyman.

O. vepratrica was found by the *Challenger* at latitude 28° S. and longitude 177° W., at a depth of 600 fathoms, near the Fiji Islands. It was afterwards met with by the *Blake* in several localities of the West Indies, near Nevis Island, Barbados, Martinique, St. Vincent, and Grenada, in depths of 291-476 fathoms, as well as at station 41 in 860 fathoms.

Lyman has done no more than cite the occurrence at the various above-mentioned localities without adding anything to his original description.

OPHIACANTHA VIVIPARA Ljungman.

See for bibliography:

Köhler (12), p. 138.

Albatross station 2769. Jan. 15, 1888. Lat. $45^{\circ} 22' S.$; long. $64^{\circ} 20' W.$; 51.5 fathoms; gn. m. fne. s.; temp. $56.6^{\circ} F.$ One specimen.

Albatross station 2771. Jan. 17, 1888. Lat. $51^{\circ} 34' S.$; long. $68^{\circ} 00' W.$; 50.5 fathoms; gy. s. bk. sp.; temp. $49.4^{\circ} F.$ Eleven specimens.

One specimen from station 2769 is provided with six arms; all the others have seven. The diameter of the disk ranges between 9 and 19 mm. In all of them the upper face of the disk is covered with rounded granules except in the largest one, the granules of which are somewhat elongated and conical. None of the specimens carries any young ones.

OPHIACANTHA (OPHIOPRISTIS) PERMIXTA, new species.

Plate 11, figs. 3-4.

Albatross station 2665. May 2, 1886. Lat. $27^{\circ} 22' N.$; long. $78^{\circ} 07' 30'' W.$; 338 fathoms; fne. gy. s.; temp. $45.2^{\circ} F.$ One specimen.

Type.—Cat. No. 32296, U.S.N.M.

This single specimen is, unfortunately, in very bad condition; one part of the upper face of the disk is lacking, and the latter has been stretched in one direction, which has somewhat altered its shape; moreover, three of the arms are broken on the level of their insertion on the disk, and are entirely lacking, the other two being preserved only to a length of scarcely one centimeter. However, all the characters of the species are very clear, and one can easily ascertain that they do not refer to any known form.

The diameter of the disk measures 13 mm. in one direction and about 10 mm. in the other direction; the outline is pentagonal and the sides are almost straight.

The upper face is covered all over with granules which are rounded, unequal, rough, and very closely arranged; besides, between these granules, there are fairly strong, elongated, conical, and pointed spines, the number of which is rather important. The whole somewhat reminds one of the arrangement known in *Ophiolimna mixta* (Lyman) or *littoralis* Köhler; but here the granules lie more closely and the spines (the shape of which, by the way, is different) are much more pointed. The underlying plates are completely invisible, and so are the radial shields. But the covering of the upper face of the disk does not stop at the issue of the arms, for the granules extend to a certain length of the upper face of the arms, that is to say on four or five articles at least. But these granules, instead of remaining rounded as they were on the disk, grow longer and become completely conical and pointed; they are at least twice higher than wide, and they may henceforth be called small spines. These pointed granules can not be compared with the large spines of the upper face of the disk, which stop at the margin of the latter and do not extend on the upper face of the arms. These little conical granules first lie fairly close at the base of the arms; then they rapidly become few and far between until they are finally lodged near the distal margin of the upper brachial plates in the median part of the said margin. On the last article preserved they amount to four, and I do not know on how much more of the arm they may occur.

The under part of the disk in the interradial spaces appears covered with imbricated and distinct scales, especially in its proximal half. It shows, near the margin, spines which are rather close to one another, and identical with those of the upper face, but the granules are very scarce; the spines are farther apart and shorter proximally, advancing, however, up to the neighborhood of the mouth shields.

The latter are very large. Their chief part is triangular, wider than long, with a fairly sharp proximal angle, the apex of which, though, is generally somewhat rounded and limited by two straight or slightly incurved sides; the side angles are broadly rounded, and the distal side is occupied on most of its length by a wide and much protruding lobe, having a rectangular shape, rounded lateral angles, and a free margin, which is itself rounded and may carry one or two spines identical with the neighboring ones. The adoral plates are extremely thin and most elongated; they become a little thicker internally and grow up so as to lean against each other for a certain length, following the interradial median line; they also grow a little wider outwardly, embracing the external angle of the mouth shield, but they supply only an extremely narrow blade, which scarcely separates this shield from the first brachial side plate; their two margins are slightly sinuous, and the free margin is rather deeply notched on the level of the large tentacular oral pore. The oral plates are large, high, and quadrangular, with parallel margins. They show on their free edge a set of oral papillæ, of medium size, conical and pointed; then, on the level of the tentacular oral pore, there appear two very long cylindrical and pointed spines, which are of equal size, one of which is still inserted on the oral plate, while the other issues from the adoral plate. On the under face itself of the oral plates I observed in but one case a papilla located near the distal edge. At the proximal end of each oral plate there is found a large conical papilla, larger than the neighboring oral papillæ, but it does not seem to me that there should be other papillæ in the same region, although I find in one place two very unimportant little swellings; moreover, these parts are far from being entire.

The first upper brachial plates have their outlines almost completely hidden by the conical granules which cover them all over; they seem to me likely to be more or less divided up. The plates which come next to the aforesaid, and only two or three of which are preserved, are rather narrow, a little longer than wide, triangular, with a rounded proximal angle limited by two slightly convex sides, joining by broadly rounded angles the very convex distal side. All the preserved plates are contiguous.

The first under brachial plate is elongated and narrow, triangular, with a concave distal side and a very acute proximal angle; it is already separated from the second one. All the other succeeding plates may be considered as pentagonal, with an extremely obtuse proximal angle, limited by two concave sides, two divergent lateral sides, which are deeply excavated by the large corresponding tentacular pores and united to the distal side by elongated and acute angles; this distal side is very wide and shows in its middle a strong notch. The proximal part of the plates is always narrower than the distal part, and these plates are narrowed in their middle. They are all longer than wide and widely separated by the lateral plates.

The latter are not protruding and each bears five spines, which remain applied on the lateral faces of the arms. The first under spine, which is cylindrical with a blunt point, is a little longer than the article, but the length does not grow much up to the last one. The following spines are flattened and they may bear on their edges, and more especially on their upper edge, extremely strong and protruding teeth, which are broadly conical and sharp; these teeth are often few, but then they are generally widely set apart; they are more numerous on the spines of the first articles. Moreover, it seems to me that the spines appear especially flattened and strongly denticulated on the first brachial articles only, while they assume beyond that point a more cylindrical shape at the same time as the teeth disappear, but as I can study their characters only on very short arm pieces, I can not possibly assert anything on the subject.

The tentacular pores are rounded and extremely large; their diameter exceeds half the length of the article. I have previously said that each of the tentacular oral pores carried on its interrational edge two very long and thick spines; they are, in fact, as long as one and a half brachial articles; on the contrary, the radial edge of these pores is completely unarmed. The following two or three pairs of pores are absolutely deprived of spines and not until the third or fourth pore does appear, near the middle of the external side of the brachial under plate, a pretty thin spine, which is very long, as long in fact as two-thirds of the article; this spine represents the single tentacular scale of each brachial pore. The two spines of the same article are parallel and pretty regularly directed toward the extremity of the arm. I have not succeeded in finding any indication either of a second spine or of a second tentacular scale, although, in spite of their thinness, most of the spines are preserved, and where they have been torn away the small tubercles on which they were inserted can easily be recognized. If there were a second spine, a trace of it could certainly be found, so that I think I am justified in stating that each tentacular brachial pore has a single scale in the shape of a long and thin spine, inserted on the radial edge and lacking on the first articles.

The color of the sample in alcohol is white.

Connections and Differences.—*O. permixta* is evidently closely allied to *O. cervicornis* described by Lyman (83, p. 257) from specimens found by the *Blake* in the Caribbean Sea, between 208 and 573 fathoms, and which Verrill classified in his genus *Ophiopristis* (99 a, pp. 336, 337, 338, and 347). But the new species is clearly distinct from the latter, owing to the spines of the tentacular oral pore being only two, owing to there being one spine only instead of two on the radial edge of the brachial tentacular pores, and lastly, owing to the very different shape of the mouth shields, which display a very wide distal lobe. I can not compare the two species regarding the disk armature and the number of the brachial spines. In fact, Lyman says "disk densely beset with short rounded pointed spines," and he indicates five brachial spines (83, p. 258), while Verrill writes (99 a, p. 347): "Disk and radial shields covered with fine granules and small acute spines," and at the same time he indicates six brachial spines, while in the same work, a few pages before (p. 336), he mentions only five.

OPHIACANTHA (OPHIOTRETA) AFFINIS, new species.

Plate 13, figs. 1-3.

Albatross station 2156. Apr. 30, 1884. Lat. $23^{\circ} 10' 35''$ N.; long. $82^{\circ} 21' 55''$ W.; 278 fathoms; co.; temp. 59.8° F. One specimen (type).

Albatross station 2321. Jan. 17, 1885. Lat. $23^{\circ} 10' 54''$ N.; long. $82^{\circ} 18' 18''$ W.; 230 fathoms; fine gy. s. Two specimens.

Albatross station 2346. Jan. 20, 1885. Lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W.; 200 fathoms; co. One specimen.

Albatross station 2348. Jan. 20, 1885. Lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W.; 211 fathoms; co. One specimen.

Type.—Cat. No. 7178, U.S.N.M.

The diameter of the disk ranges from 14 to 16 mm., and in one of the specimens from station 2321, it does not exceed 11 or 12 mm. The arms are seldom complete and they are broken at a certain distance from the base, but they are long, and, in the smallest example from station 2321, one arm, which remains complete, measures 110 mm. Besides, the specimens are generally not in very good condition and they have undergone some friction which has often taken away part of the spines of the upper face of the disk; this face itself is sometimes torn.

This species is very interesting because it recalls, by several characters, *Ophiopristis ensifera* of Verrill, while by some others it is near *Ophiacantha* (*Ophiotreta*) *valenciennesi*. I shall describe it chiefly from the sample from station 2156, the diameter of the disk of which reaches 15 mm., and two arms of which are preserved to a certain length (70 and 55 mm., respectively).

The disk is rounded or subpentagonal. The upper face, slightly convex, is covered with small, thin, imbricated plates, the outlines of which are well perceived only when the spines borne by them are removed. Each of them is provided with a short and conical spine, which is very thick at its base, so as to beset a large part of the surface of the plate, two or two-and-a-half times longer than wide and provided on its surface with fairly strong asperities which often become a little more conspicuous at the end of the spine, where there are always two or three of them. These spines always leave bare the radial shields, the outlines of which are quite apparent; the latter are small, oval, or triangular, with rounded angles, one-and-a-half times longer than wide, and widely separated by several rows of plates, the middle one of which often includes two or three plates which are larger than the others.

The under face of the disk is covered in the interradial spaces with plates identical with those of the upper face, but deprived of spines, and extending as far as the mouth shields. The genital slits are long and narrow.

The mouth shields are large and widened and recall those of *Ophiopristis ensifera* of Verrill; they are triangular with a fairly open proximal angle which is limited by straight or slightly incurved sides; the lateral angles are very wide and strongly rounded; finally the distal side offers in its middle a wide lobe which does not very strongly protrude into the interradial space; these shields are one-and-a-half times wider than long. The adoral plates are narrow and greatly elongated, inwardly widened, and they rest against each other, following the interradial median line, for a fairly important length; they become narrower in their middle

region and wider again outwardly, where they build a blade which, besides, is very thin, and which separates the mouth shield from the first lateral brachial plate. The oral plates are very high and narrow, and do not exceed the middle of the adoral plates. The oral plates bear on their free edge a sometimes rather irregular row of oral papillæ which most generally amount to seven; these papillæ are conical, elongated and rather narrow, with an obtuse end; sometimes there are one or two supplementary papillæ intercalated among the normal ones, breaking the arrangement of the latter. The two external papillæ scarcely differ from their neighbors; they are, however, a little shorter and also slightly more widened and more obtuse, but they can hardly be said to offer a peculiar differentiation. This row of oral papillæ suddenly stops outwardly, and it scarcely reaches the third part or the middle of the tentacular mouth pore which remains absolutely unarmed around its entire outline. In none of the specimens do I observe the slightest indication of papillæ, either on the external or the internal side of this pore, neither do I observe it on the under face of the oral plate. At the extremity of the jaws, there appear sometimes two and sometimes three large tooth papillæ.

The shape of the upper brachial plates suggests that of *Ophiopristis ensifera*. These plates are, however, comparatively a little wider than in the latter species, and, besides, their shape is plainly triangular and not lozengelike; they offer, over their whole length, a slight median crest. The very obtuse proximal angle is limited by two slightly convex sides; the convex distal side offers, in its middle, a small lobe which corresponds to the median keel; the lateral angles are very sharp. On the first brachial articles, the median protuberance of the distal side is more conspicuous, and this side itself may be resolved into two sides which meet by a protruding and very obtuse angle. These plates are almost twice wider than long and they are all contiguous.

The first brachial under plate is fairly small, trapezoidal, with a proximal side which is larger than the distal side; these two sides are slightly convex and the lateral sides are diverging. The following plates are pentagonal with a very obtuse proximal angle, diverging lateral sides which are very widely excavated by the corresponding tentacular scales, and a very wide and strongly convex distal side. In the largest specimens the first two or three plates have their proximal angle opened to such an extent that it almost reaches 180° and the outline then becomes simply rectangular. These under brachial plates are, first, much wider than long, then they become narrower and just as wide as long, and finally they are longer than wide; they always remain contiguous. The middle of each plate is slightly protruding, chiefly near the proximal angle. On the surface of these plates and mainly at a certain distance from the disk, one can see a mark consisting of two lines which, starting from each antero-lateral angle, meet at an acute angle at a certain distance in front of the distal side. This mark is not nearly so plain at the beginning of the arms, where, besides, the two lines form a less acute angle; it is analogous to that which Lyman has indicated in *Ophiacantha placentigera*, a species which Verrill also has classified in his genus *Ophiotreta*, but here it extends over a greater length of the plate.

The lateral plates have on their distal side, which is fairly protruding and thickened, five flattened, transparent spines which are provided on their edges

with extremely small, dense, and regular denticulations; these denticulations appear almost on the whole length of the spines, excepting just near their basis, and they become a little stronger toward the end. The length of the spines increases from the first ventral, which reaches or even exceeds one-and-a-half articles, to the last dorsal one which equals at least two-and-a-half articles; this latter spine is often narrower than the others. On the large specimens one often finds seven spines on the first articles, then they fall back to six and finally to five.

The tentacular scales first amount to two, a figure which is maintained over a certain length of the arms, sometimes even over three centimeters, then, after some irregularities, there finally remains but one tentacular scale. The external scale is always much more developed than the internal one; it is large, triangular, very much widened at the base and its end is pointed except on the first articles where it is wider and almost oval; the surface is rough. The internal scale, partly covered by the foregoing one, is shorter and narrower and its apex, which is less pointed, often offers one or two little spinules. These two scales extend regularly, with the characters I have just described, on to a certain number of articles; then, at a variable distance from the base of the arms, the internal scale is seen to disappear, either on one side or on the other, or on both sides at the same time, then it appears again a little further on to disappear again and sometimes to reappear once more, all of it in a very irregular manner. Sometimes after a large number of articles which show but one tentacular scale on each side, one sees the internal scale suddenly appear again on a single article, either on the right or on the left. Be it as it may, the external scale finally persists alone until the end of the arms. The pores of the first pair have sometimes three scales which are then smaller than the two normal ones.

The color of the specimens in alcohol is a light brownish-yellow identical with what is known in *O. valenciennesi*, but that from station 2348 is simply greyish. One can still trace two fairly wide longitudinal lines, of a somewhat darker brown, which run on each side along the upper median line of the arms.

Connections and differences.—This species is very interesting, because, as I have pointed out above, it recalls both *Ophiopristis ensifera* and *Ophiacantha* (*Ophiotreta*) *valenciennesi*. The arrangement of the oral papillæ does not permit its being classified in the genus *Ophiopristis* of Verrill, but the shape of the upper and under brachial plates, as well as that of the mouth shields, the presence of fairly large radial shields and the armature of the plates of the upper face of the disk consisting of small and short echinulated spines, recall *Ophiopristis ensifera*. *O. affinis* is near the few species classified by Verrill in his subgenus *Ophiotreta*, and chiefly near *O. valenciennesi* with which it was even associated at station 2321. It plainly differs from the latter species by the tentacular scales, two of which appear on a certain part of the length of the arms and have quite a different shape, by the mouth shields being large and broadly widened instead of small and elongated, by the scales of the disk being armed with real little spines instead of mere granules, by the brachial spines being beset with denticulations over their whole length and not only in the terminal part, and chiefly by the shape of the external oral papillæ which are hardly different from the preceding ones. Owing to this latter character, *O. affinis* has its place just at the limit of the genus *Ophiotreta*.

OPHIACANTHA (OPHIOTRETA) SERTATA (Lyman).

Ophiomitra sertata LYMAN (69), p. 326.

Ophiomitra sertata LYMAN (78), p. 231.

Ophiacantha sertata LYMAN (82), p. 198.

Ophiacantha sertata LYMAN (83), p. 261.

Ophiotreta sertata VERRILL (99), pp. 40 and 54.

Ophiotreta sertata VERRILL (99a), pp. 336, 337, 338, 348.

Ophiacantha sertata KÖHLER (07), p. 321.

Albatross station 2342. Jan. 19, 1885. Lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W.; 201 fathoms; co. One specimen.

Albatross station 2350. Jan. 20, 1885. Lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W.; 213 fathoms; co. Four specimens.

Albatross station 2655. May 2, 1886. Lat. $27^{\circ} 22'$ N.; long. $78^{\circ} 07' 30''$ W.; 338 fathoms; gy. s.; temp. 47.5° F. One specimen.

The diameter of the disk ranges between 5 and 8 mm.; the specimens from Station 2350 are in a fairly good state; the others have most of their arms broken near the base.

This species was placed by Verrill in his subgenus *Ophiotreta*. The description which Lyman published in 1869 is very complete and little has been added to it since. In 1907, I published a drawing of the under face after two specimens from the dredgings of the *Blake* which were given to the Jardin des Plantes.

I find again, on the distal side of the mouth shields, the few little spines which were reported by Lyman. The brachial spines are more or less flattened and translucent. Lyman wrote, in 1869, that the spines, amounting to seven, were all rough; in both specimens in the Jardin des Plantes, the spines are provided with fairly minute and dense denticulations. In the specimen from station 2655, these denticulations are a little stronger and, besides, somewhat irregular and unequal; among those from station 2350, the said denticulations are a little more apparent on the largest specimens. The brachial pores of the first pair often carry two scales, as I indicated in 1907.

The first upper brachial plates are often contiguous at the bases of the arms, chiefly on the somewhat large specimens, then they part. In no specimen are there any granules on the oral plates and the radial shields are always distinct; both these characters allow *O. sertata* to be distinguished from *O. lineolata* to which it is closely allied.

OPHIACANTHA (OPHIOTRETA) VALENCIENNESI Lyman.

See for bibliography:

Köhler (09), p. 188.

Albatross station 2320. Jan. 17, 1885. Lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 18' 48''$ W.; 130 fathoms; fine. co. Two specimens.

Albatross station 2321. Jan. 17, 1885. Lat. $23^{\circ} 10' 54''$ N.; long. $82^{\circ} 18'$ W.; 230 fathoms; fine. gy. s. Three specimens.

Albatross station 2334. Jan. 19, 1885. Lat. $23^{\circ} 10' 42''$ N.; long. $82^{\circ} 18' 24''$ W.; 67 fathoms; wh. co. One specimen.

Albatross station 2415. Apr. 1, 1885. Lat. $20^{\circ} 44' N.$; long. $79^{\circ} 26' W.$; 440 fathoms; co. ers. s. sh. for.; temp. $45.6^{\circ} F.$ Fifteen specimens.

Albatross station 2663. May 4, 1886. Lat. $21^{\circ} 56' N.$; long. $79^{\circ} 49' W.$; 421 fathoms; br. s.; temp. $42.7^{\circ} F.$ One specimen.

Havana. One specimen.

The shape of the mouth shields varies somewhat, the proximal angle being more or less elongated and pointed, but they are always longer than wide. The granules of the upper face of the disk extend generally over to the first one or two upper brachial plates, and, on certain specimens, especially on some from station 2415, one may observe on the plates at the bases of the arms, from two to four very short spines which start from the middle of the distal side.

I have already called attention to the wide geographical range of *O. valenciennesi* (06, p. 293, and 09, p. 189). The discovery of this species at station 2334 is very interesting since it shows that it can come up as high as 67 fathoms. I have examined with special attention the specimen from that station; though rather small, the diameter of the disk not exceeding 7 mm., it is quite characteristic and there can be no doubt as to its identity.

OPHIOMITRELLA AMERICANA, new species.

Plate 15, figs. 1-2.

A single example found on a branch of *Platycaulis danielsseni*.

Type.—Cat. No. 32297, U.S.N.M.

The diameter of the disk reaches 6.5 mm. The arms are not complete; they are preserved to a length of 12 to 15 mm. and could not have been very long.

The disk is subpentagonal. The upper face is covered with fairly thick and sharply outlined plates, rather large, somewhat unequal, polygonal, with more or less rounded angles and not imbricated. These plates bear large thick globules which are a little higher than wide and cylindrical with rounded ends and carry very short, fine, and pointed spinules. The smaller plates bear but one globule each but most of them have two and few have even three; nevertheless these globules always remain broadly separated from each other and are relatively few; they lie closer to one another only at the margin of the disk. The radial shields, of medium size, are larger than the largest plates of the disk, triangular, with a plainly rounded proximal apex; they are as long as wide or a little longer than wide; their surface is completely bare, but on their external edge are found a certain number of granules, amounting to about half a dozen, identical with those existing on the margin of the disk. These shields are wide apart and the intervals between them are beset by plates which are usually arranged in one row only and may reach a large size. The under face of the disk is covered all over with plates similar to those of the upper face, but smaller, somewhat imbricated, and carrying granules which, on the margin, are identical with those of the upper face which they succeed; these granules become smaller and less rough as they lie nearer the mouth shields. The genital slits are very wide.

The mouth shields are middle-sized, triangular, much wider than long, with an elongated proximal angle which has a rounded apex; the two lateral sides, slightly excavated, meet the strongly convex distal edge by rounded angles; in the middle

of the said distal edge there is a little lobe which is not very conspicuous. The adoral plates are elongated, three times longer than wide, with parallel and slightly incurvate sides; they are somewhat narrower inwardly and outwardly and they do not separate the mouth shields from the first lateral brachial plate. The oral plates are rather small and triangular. The oral papillæ, amounting to three on each side, are flattened, lanceolate, with a more or less blunt point; the external papilla is a little wider than the others. The odd terminal papilla is a little more developed than the next ones. The surface of these papillæ is covered with very fine rugosities.

The first upper brachial plate is quadrangular and extremely short. The second is longer and much more developed but it still remains quadrangular with a very wide and convex distal side and divergent lateral sides. The following plates are rather large, triangular, with an acute proximal angle, a convex distal side and divergent lateral sides. Some globules, analogous to those of the upper face of the disk, appear on the first brachial plates; the first plate shows four or five such granules set in a row, generally on its distal margin; the second plate also displays, on its distal margin, a little row of three such globules; lastly, the seven or eight succeeding plates have each, on the middle of their distal margin, a single globule which is somewhat more elongated than the preceding ones. These globules seem to fall off easily and they are lacking on several plates; on one of the arms, however, I find them very regularly preserved up to and including the seventh plate; beyond it, they are always absent and I find no scar indicating their presence.

The first under brachial plate, fairly large, is quadrangular, with a widened and almost straight proximal side, oblique lateral sides meeting, by means of rounded angles, the distal side, which is narrow and also rounded. The succeeding plates are fairly large and pentagonal, with a very obtuse proximal angle, straight lateral sides, and a very convex distal side, which often displays, in its middle and on the first plate, a small notch, more or less conspicuous. The second and third plates are a little wider than long; beyond them the plates become as wide as long, and finally a little longer than wide. They are separated from the second one.

Each lateral plate, fairly protruding, carries on its distal side five spines, the length of which increases from the first ventral, which is equal to the article, to the fourth, equal to one and a half articles; the fifth spine is somewhat shorter. These spines are cylindrical, fairly pointed, and they bear dense and sharp asperities, some of which even rise to more conspicuous denticulations, which, however, are generally few in number.

The tentacular scale, always single, is very large, widened and lanceolate, and its surface is rough; its length almost reaches that of the corresponding brachial plate.

Connections and differences.—*O. americana* is very near *O. globulifera* (Kœhler), which I have dredged on board the *Caudan* in the Bay of Biscay; it differs from it, first by the characters of the globules of the upper face of the disk, which are rounded, transparent, and completely smooth in *O. globulifera*. Moreover, the globules are completely lacking on the upper brachial plates in this latter species. The tentacular scale is stronger in *O. americana*, and the outlines of the mouth pieces are somewhat different in the two species.

OPHIOMITRELLA LEVIS, new species.

Plate 10, figs. 1 and 6.

Albatross station 2666. May 5, 1886. Lat. $30^{\circ} 47' 30''$ N.; long. $79^{\circ} 49'$ W.; 270 fathoms; gy. s.; temp. 48.3° F. Two specimens.

Type.—Cat. No. 32298, U.S.N.M.

Both specimens are small and the diameter of the disk does not exceed 4.5 to 5 mm.; neither of them is complete, and the arms are broken more or less near the base. In the smaller one the disk is almost circular, whilst in the larger one it is pentagonal, with rather excavated interradial spaces.

The upper face of the disk is indented at the base of the arms; it shows five pairs of protruding ribs, which succeed the very small radial shields and it offers in its central region a depression which follows each radius to the base of the arms between the radial shields. This face is covered with scales, which are very small, rounded, and imbricated; each of them bears a small stump, which is very wide at the base and becomes rapidly thinner, in the shape of a peduncle, becoming again wider at the end, which carries a crown of from six to eight very small diverging spinules very regularly arranged. These stumps are closely approximated to one another, owing to the small size of the plates which carry them; they form a very regular and uniform covering over the upper face of the disk. One perceives at the end of each radial rib a very narrow little shield, which is elongated, triangular, and has a bare and finely granulous surface.

The under face of the disk offers in the interradial spaces a covering similar to that of the upper face, but the plates are less dense, and the stumps grow thinner at the same time as the terminal spinules are fewer and shorter, but these stumps extend up to the external edge of the mouth shields. The genital slits are plainly visible.

The mouth shields are middle-sized, triangular, with an acute proximal angle limited by two concave sides which join by sharp angles the distal side, which is very strongly convex; they are scarcely wider than long. The adoral plates are very much developed and remarkably wide, one and a half times longer than wide; they are narrowed in their distal part, and they do not separate the mouth shield from the first lateral brachial plate. The oral plates are rather small, triangular, fairly high. The oral papillæ number three on each side; they are middle-sized and conical, except the external papilla, which is rather obtuse; the odd terminal papilla is wide, thick, and strong, often with a truncated apex; the surface of these papillæ is very rough. It should be noted that the distal sides of the mouth shields, of the adoral plates, and of the first under brachial plate, build together the sides of a regular pentagon, which is very conspicuous, has straight sides, and the angles of which, corresponding to the distal sides of the mouth shields, are rounded.

The arms are moniliform. The first two upper brachial plates are triangular, with a rather acute proximal angle and a slightly convex distal side; they are a little wider than long, and their dorsal surface is somewhat protruding. From the third plate upward this face becomes more convex at the same time as the proximal angle gets rounded, and the distal side becomes wider as well as more convex; the plates thus offering some likeness with the campanuliform type. They are separated from the base of the arm.

The first under brachial plate is fairly large, trapezoidal, with the proximal side widened and slightly excavated in its middle; the lateral sides are oblique and they meet by rounded angles a small distal side; this plate is somewhat longer than wide in the smaller sample and, on the contrary, it is a little wider than long in the larger one. The next plates are large, pentagonal, with a proximal angle, which is still fairly well delineated on the second plate, but which afterwards becomes very obtuse; the lateral sides are narrow and the distal side is very wide and slightly convex. These plates are always much wider than long, and they are separated from the basis of the arm by an interval which becomes fairly long from the second plate upward.

The lateral plates are fairly protruding and they carry nine spines each at the basis of the arms; the two rows on each side are very much approximated dorsally. The length of the spines increases from the first ventral one, which is shorter than the article upward, to the last two dorsal ones; the latter scarcely exceed one and a half articles at the basis of the arms, and afterwards become much shorter. These spines are thin, cylindrical, and pointed; they are provided with fine and dense denticulations, which are particularly obvious on the ventral spines, and less so on the dorsal side.

The tentacular scale is small, conical, with a blunt point, and its surface is rough.

Connections and differences.—*Ophiomitrella levis* seems to me to be very near *O. lævipellis* (Lyman), which it recalls by its small size, by the shape of the upper and under brachial plates, by a like arrangement of the mouth pieces, etc. It differs from it in having the covering of the disk made of stumps regularly ending in a diverging bunch of minute spinules, whilst in *O. lævipellis* these plates carry only some rounded globules which seem to be much caducous, for the plates are most often bare; the oral papillæ regularly amount to three in the two examples of *O. levis* which I had in hand, whilst in *O. lævipellis* they vary in number even in the same specimen. Lastly, the brachial spines are more strongly echinulated than in the new species. Though *O. lævipellis* is likely to offer certain variations, which have been studied chiefly by Verrill (99 a, p. 343), these variations are of a kind which does not allow of *O. levis* being united with *O. lævipellis*; especially the covering of the upper face of the disk remains as a most striking characteristic of the new species.

OPHIOMITRELLA LÆVIPELLIS (Lyman).

Plate 13, figs. 4-5.

Ophiacantha lævipellis LYMAN (83), p. 259, pl. 6, figs. 82-84.

Ophiomitrella lævipellis VERRILL (99), pp. 39, 43.

Ophiomitrella lævipellis VERRILL (99a), pp. 326, 332, 343, and 352.

Albatross station 2159. Apr. 30, 1884. Lat. 23° 10' 39'' N.; long 82° 20' 08'' W.; 98 fathoms; co. A single specimen.

The diameter of the disk is only 5 mm. The specimen is rather incomplete; two arms are completely lacking and the others are only partly preserved. The example is quite in conformity with Verrill's description, which has completed and corrected Lyman's, and the very small granules of the upper face of the disk are very few; I have, besides, compared it with a specimen determined by Verrill which has been sent to me by the United States National Museum.

OPHIOMITRELLA PORRECTA, new species.

Plate 12, figs. 5-6.

Albatross station 2781. Feb. 4, 1888. Lat. $51^{\circ} 52' S.$; long. $73^{\circ} 41' W.$; 369 fathoms; bu. m.; temp. $49.9^{\circ} F.$ Three specimens.

Type.—Cat. No. 32299, U.S.N.M.

The diameter of the disks measure, respectively, 6.5, 4.5, and 3 mm.; in the largest specimen the length of the arms reaches 28 mm.

The disk is rounded and subpentagonal but not excavated in the interradial spaces. The upper face is covered with fairly large imbricated plates, the outlines of which are not very conspicuous in the largest specimen, owing to their being hidden by the tegument, but these outlines are more distinct on the two smaller specimens. On the latter, also, it is more easy to discern the presence of small elongated radial shields, which are triangular and narrow, widely separated, while they are hardly distinct from the neighboring plates on the largest specimen. Each plate carries a large spine which is very rough, rather short, thick at its base, and has about the same width over its whole length. At the end of the said spine appear a few large unequal, and irregularly arranged spinules, which may in turn carry some secondary denticulations; it happens often, but not constantly, that the spinules amount to three and are arranged divergently. The length of the spines is variable. Instead of being cylindrical, the spines may be simply conical, and, in this case, they are provided only with strong rugosities.

The under face of the disk is covered with rounded and imbricated plates, the outlines of which are more distinct than on the upper face, and each of which carries a conical spine which extends as far as the mouth shield. These spines are always very rough, but the terminal crown of spinules has disappeared. The genital slits are wide.

The rather small mouth shields are lozenge-shaped with an obtuse proximal angle, a very much rounded distal angle, almost equal and straight sides; they are somewhat wider than long. The rather small adoral plates are fairly wide, but short, twice or two and a half times longer than wide; they are widened outwardly, but they do not separate the mouth shield from the first lateral brachial plate. The oral plates are narrow and elongated. The oral papillæ amount to three on each side; they are elongated, conical, and rough, fairly strong; the external oral papilla has about the same shape as the other two, although its end is a little more obtuse. The single tooth papilla is a little stronger but of the same shape as the neighboring ones.

The middle-sized upper brachial plates are triangular, with a fairly open proximal angle and a convex distal side; they are about as wide as long, or a little wider than long, and widely separated from the basis of the arms.

The first under brachial plate is fairly large, pentagonal, with a narrow proximal side, two diverging lateral sides excavated by the tentacular mouth pore, and two distal sides which meet by a very obtuse angle. The succeeding plates are pentagonal, with an obtuse proximal angle, lateral sides which are slightly excavated by the tentacular scale, and a wide and convex distal side. These plates are at first a little wider than long, then they finally become a little longer than wide;

also their distal side becomes more and more convex and even protruding. All these plates are separated from one another from the first one upward.

The fairly protruding lateral plates carry six spines each. The first ventral one is very short and thin; the two following ones are about equal to the article, then the length increases up to the last dorsal one which exceeds two articles at the base of the arms; the rows formed by these spines are not dorsally approximated. These spines are thin and pointed, beset with small denticulations which, as a rule, are very thin, conical, and rather loosely distributed. These denticulations, which are never much developed, appear chiefly on the ventral and lateral spines and become less apparent on the last dorsal spine.

The tentacular scale is large, strong, lanceolate, with an obtuse point, and its surface is strongly rough; it is notably longer than half the corresponding brachial plate.

Connections and differences.—*O. porrecta* stands evidently at the limit between the genus *Ophiacantha* and the genus *Ophiomitrella*, for the plates of the upper face of the disk, although being not only apparent but very plain on the younger specimens, become somewhat indistinct as they grow older. Besides, I note a like peculiarity in other Ophiacanthidæ and, especially, in *Ophiacantha aristata* Koehler, where, however, the plates remain somewhat easier to perceive on the larger samples. It is with this latter species that *O. porrecta* is most closely allied. It differs from it in having the plates of the upper face of the disk bear actual spinulose spines instead of those stumps provided at their ends with those spinulose expansions which are so peculiar and which I have described and figured for *O. aristata* (09, pl. 26, fig. 6); in the upper brachial plates a little larger than in *O. aristata*, where they remain very small and compressed; in the lateral brachial plates which are stronger and which carry, on their strongly thickened distal side, spines which are more numerous, longer, and arranged in rows, which at the basis of the arms are approximated dorsally. The tentacular scale, at least, is less developed and less rough in *O. porrecta* than in *O. aristata*.

I beg to call attention to the latitude of the station where *O. porrecta* has been discovered; this species very likely represents in the Southern Hemisphere the *O. aristata* of the Northern Hemisphere.

OPHIOMITRA ROBUSTA, new species.

Plate 10, figs. 4-5.

~ Albatross station 2347. Jan. 20, 1885. Lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W.; 216 fathoms; co. One specimen.

Type.—Cat. No. 32300, U.S.N.M.

This specimen is very incomplete; two arms are completely lacking, the other three are broken off close to their bases and only a few articles are preserved; yet the disk and the remaining parts of the arms are in excellent condition and the specimen can perfectly well be described. I consider it as belonging to a new species.

The disk is thick and slightly excavated at the level of the insertion of the arms, while it is most protruding in the interradial spaces. Its diameter is 16 mm.; the arms are wide and strong; the specimen must have been very robust.

The upper face of the disk is covered with very distinct plates which are of middle size, pretty unequal, and imbricated; they display on their free margin an extremely narrow fringe. Each plate is provided with a spine which is rather strong and thick, but variably long and has always a very rough surface. Sometimes these spines are elongated, presenting a certain number of strong, conical, and pointed teeth and having at their ends a few sharp spinules; sometimes, on the contrary, they are short, although still terminated by some denticulations. The interradial spaces are especially the place where the spines are most developed, and the latter are particularly elongated at the margin of the disk, while in the radial regions they are very short and may even be reduced to simple granules, somewhat elongated and with a simply rough surface. The radial shields, clearly distinct, and of middle size, are triangular with their angles and margins rounded, a little longer than wide, and separated on their whole length by one or two ranges of plates; these shields show on their surfaces a few rounded or conical granules, loosely and irregularly arranged, somewhat smaller than the neighboring granules. Occasionally in a radius the two radial shields of the same pair are joined into a single plate.

The under face of the disk is provided with plates carrying spines identical with those of the upper face and which extend as far as the mouth shields, but the size of these spines decreases progressively until they are reduced to mere granulations in the vicinity of the said shields; their surface is still very rough but they no longer offer such very distinct denticulations as on the upper face. The genital slits are narrow and elongated.

The mouth shields, of middling size, are a little wider than long, triangular, with a rounded distal lobe, which protrudes more or less into the interradial space; the proximal angle is obtuse, limited by straight sides which unite with the convex distal edge by rounded angles. The adoral plates are rather small, with the proximal edge slightly incurved; they are wider externally, but they do not separate the mouth shield from the first brachial side plate. The oral plates are fairly large, higher than wide. The oral papillæ amount to six or seven on each side; the two external ones, widened and flattened, cover the tentacular mouth pore; the others are thinner, elongated, and conical, with a blunt point. There is, moreover, a certain number of tooth papillæ which are not all preserved in this specimen, but the trace of which, at least, may be detected; some of them, amounting to three or four, are a little larger than the oral papillæ and directed horizontally; the others, amounting to about the same number and arranged behind the former, are smaller and directed obliquely downwards.

The upper brachial plates are rather small and about as long as wide; they are triangular or lozenge-shaped, according to the outline of the distal edge which is sometimes very strongly convex, sometimes plainly bent into two distinct sides joined by a more or less blunt angle; the proximal angle is fairly open; the lateral edges are divergent and join by very sharp angles on the distal side. These plates are separated by a narrow interval. One can plainly distinguish, all along the distal margin of the said plates, a set of very fine, sharp, and short little spines; moreover, on closer examination, some similar but still shorter little spines will be seen which are irregularly scattered over all the upper face of the plate. The

lateral parts of the upper plates have preserved a brownish-pink color, and there is, besides, a large purple-brown spot on the lateral plates on either side of the distal edge of the upper plate; the whole must have had in the live animal the appearance of a bicolored stripe extending all along the upper face of the arms.

The first under brachial plate is small, quadrangular, longer than wide, narrow between the two corresponding adoral plates; the narrow proximal side is divided into two parts by a median furrow extending on the under face of the plate. The following plates are very large, quadrangular, having a convex distal side and lateral edges, which are divergent and strongly excavated at the corresponding tentacular scale; one can hardly speak of a proximal angle, except for the first plates, where this angle is very obtuse, while it reaches 180° on the following plates, the sides of this angle being continuous and transverse, forming a proximal side. The first plate is already a little wider than long, but the following ones grow very rapidly wider until they become almost twice wider than long; these plates are almost contiguous, the interval between them being extremely narrow.

The lateral brachial plates are short, but their distal side is very wide and thick. They each are provided at the basis of the arms with nine large and strong spines, the first ventral being equal to one and a half articles, and the last dorsal exceeding four articles; the rows are not approximate dorsally. These spines are provided with fine denticulations loosely spread but not very conspicuous and which generally are even completely lacking on the large upper spines.

The single tentacular scale is extremely developed; it is wide, thick, and lanceolate, ending in a blunt and scarcely rough point; the length of that scale almost reaches that of the corresponding brachial under plate. The first pore carries always two scales, but the following ones have but one; however, I exceptionally find on one of the arms another pore provided with two scales.

Connections and differences.—*O. robusta* is allied chiefly to *O. ornata* Verrill and *O. spinea* Verrill. It can easily be distinguished from *O. ornata*, the radial shields of which are contiguous on their whole length, and the mouth shields, as well as the upper and under brachial plates of which, have a different shape; moreover, the brachial spines amount to five only; the characters of this species clearly appear in Verrill's figures. The second species has not been represented and is known only by a rather short description by Verrill; the radial shields are externally contiguous; the adoral plates are thick and crescent-shaped; the brachial spines, which amount to nine, as in *O. robusta*, are provided with very strong denticulations; lastly, the oral papillæ are much more numerous. All these characters fail to apply to the specimen gathered by the *Albatross*, but, unfortunately, Verrill gave no information regarding the shape of the under and upper brachial plates of *O. spinea*, which plates are especially characteristic in *O. robusta*.

OPHIOMITRA VALIDA Lyman.

See for bibliography:

Verrill (99a), p. 353.

Fish Hawk station 7280. Feb. 14, 1902. Lat. $24^\circ 17' 05''$ N.; long. $81^\circ 58' 25''$ W.; 132 fathoms; s.; temp. 52° F. Five specimens.

Fish Hawk station 7281. Feb. 14, 1902. Lat. $24^\circ 13' 45''$ N.; long. $81^\circ 58' 15''$ W.; 304 fathoms; s.; temp. 52° F. Two specimens.

The diameter of the disk is generally about 10 mm.; in the larger specimen it is 13 mm., and in the smaller 5.5 mm.

The description which has been given by Lyman of *O. valida* was established on some young specimens; it was completed by Verrill, who made this species the type of the genus *Ophiomitra*, s. str., and I can but refer to that author's work.

O. valida is not much known, except in the Caribbean Sea and on the coasts of Florida, but it has a very wide bathymetrical distribution, for it is said to extend between 10 and 1,105 fathoms.

OPHIOPORA BARTLETTI (Lyman).

See for bibliography:

Kœhler (09), p. 195.

Albatross, 1886. Bahamas. No depth mentioned. One specimen.

The specimen is in very bad condition; the upper face of the disk has been torn out and the arms are broken about the base, but still it is quite characteristic.

OPHIOLIMNA LITTORALIS Kœhler.

Ophiolimna littoralis Kœhler (13), p. 370, pl. 21, figs. 1-3.

Havana, three specimens; no depth indicated.

The diameter of the disk ranges between 7 and 10 mm. I have mentioned these specimens in the description which I have recently given of this new species, to which please refer.

OPHIOLEDA MINIMA Kœhler.

Ophioledda minima Kœhler (07), p. 293, pl. 21, figs. 44, 45.

Ophioplithaca oclusa Kœhler, Bull. Musée Océan. Monaco, No. 99, 1907, p. 4.

Ophioledda minima Kœhler, Mem. Soc. Zool. France for 1906, vol. 19, 1908, p. 26.

Ophioplithaca oclusa Kœhler (09), p. 194, pl. 28, figs. 5, 6.

Albatross station 2666. May 5, 1886. Lat. 30° 47' 30'' N.; long. 79° 49' W.; 270 fathoms; gy. s.; temp. 48.3° F. A few specimens.

Albatross station 2667. May 5, 1886. Lat. 30° 53' N.; long. 79° 42' 30'' W.; 273 fathoms; gy. s. bk. sp.; temp. 48.7° F. Numerous specimens.

Fish Hawk station 7283. Feb. 19, 1902. Lat. 24° 17' 30'' N.; long. 81° 53' 30'' W.; 127 fathoms; s. gr.; temp. 53° F. One specimen.

About this species there has arisen a very unfortunate confusion and I am glad to avail myself of the present opportunity to clear it up. This confusion is accounted for by some delays, due to no fault of mine, in the printing or publishing of preliminary notes or of final papers in which I gave the description of this Ophiuran. I had introduced the genus *Ophioledda* and described *O. minima* in volume 19 of the Mémoires de la société zoologique de France; my manuscript, transmitted in 1907, was not published until 1908 in a volume dated 1906; meanwhile, the report of the Expéditions Scientifiques du *Travailleur* et du *Talisman* containing my final paper on the Ophiurans gathered by these two vessels, had been published (1907). On the other hand, in the same year, 1907, I had described the same species under the name of *Ophioplithaca oclusa*, in the preliminary note No. 99 in the Bulletin du Musée Océanographique de Monaco, without having been able to record on the proofs the synonymy of that species; the same text was printed, about the same time, in

the Résultats des campagnes scientifiques du Prince de Monaco, but the rather important pamphlet in which my paper is included did not come out until 1909; I was also unable to insert in it the synonymy which I am establishing here.

Having now explained this situation I beg to recall that *O. minima* was found by the expeditions of the *Travailleur* and of the *Talisman*, about latitude 41°-44° N., and longitude 9°-11° W., between 1,220 and 1,350 m., and by the *Princesse Alice* in latitude 32° N., and longitude 16° W., at 1,425 m.

This species is always very small, the diameter of the disk scarcely exceeding 2 to 2.5 mm.; the specimen from station 7283 is somewhat stronger than the others.

OPHIOTREMA GRACILIS, new species.

Plate 12, figs. 1-2.

Albatross station 2751. Nov. 28, 1887. Lat. 16° 54' N.; long. 63° 12' W.; 687 fathoms; bu. glob. oz.; temp. 40° F. One specimen.

Type.—Cat. No. 32301, U.S.N.M.

The sample is not perfect for the under face of the disk is partly torn away; the other parts are fairly well preserved. Almost all the arms are complete; they are slender and about 45 to 50 mm. long. The disk is somewhat disfigured and stretched along two radii, therefore one of the diameters equals 11 mm. while the other is only 8 mm.; its outline is pentagonal but the sides are unequal owing to the deformity sustained; moreover, some of the sides are straight or slightly excavated, and the others are a little convex.

The upper face of the disk is depressed and covered with small fine plates which are equal, hardly imbricated and almost rounded with very sharp outlines. Each of these plates carries at its middle a small slender spine, which is conical, rather short, with an elongated and sharp point. The radial shields, although rather small, are quite distinct from the neighboring plates; they are elongated, triangular, twice longer than wide with a rounded distal margin and a very acute proximal angle; their surfaces are absolutely bare. The two shields of each pair are arranged more or less divergently but they are always separated from each other by several series of plates.

The under face of the disk is covered all over by plates identical with those of the upper face, but the spines borne by the former do not appear except in the distal half of the disk and do not reach the mouth shields. The genital slits are narrow but plainly visible.

The mouth shields are middle-sized, triangular, much wider than long, with a widely opened proximal angle, and almost straight lateral sides joining by rounded angles the distal side which displays in its middle a rounded lobe rather strongly protruding in the interradial space. The adoral plates are extremely elongated and much thinner on all the part which is close to the mouth shield, but on the contrary broadly widened outwardly where they constantly form an important lobe which widely separates the mouth shield from the first lateral brachial plate; they are inwardly contiguous on the interradial median line, where their ends become rounded and sometimes also slightly widened. The oral plates are high and narrow. On

their free edges they each carry five conical and pointed papillæ; the most external ones are thin, then their width slightly increases up to the last one which becomes rather wide and contiguous with the median tooth papilla; these five papillæ form an uninterrupted row. There are no other tooth papillæ besides the odd median one. Off the next papilla, and isolated from it by a varying interval, there is another papilla which is inserted near the juncture of the oral and adoral plates, and which consequently corresponds to the proximal side of the tentacular mouth pore; a little further appears a second similar papilla which is also inserted on the adoral plate, but which corresponds to the middle of the tentacular mouth pore. These two papillæ are more elongated than the others and they are almost spiniform, especially the latter.

The upper brachial plates are rather small, triangular, with a convex distal edge and a fairly open proximal angle which is often slightly rounded; they are almost as long as wide. These plates are separated from the bases of the arms by an interval which progressively increases and which, beyond the first half of the arms, exceeds the length of the said plates.

The first brachial middle-sized under plate is trapezoidal, with a wider proximal side, a fairly narrow distal side and divergent lateral sides; it is already separated from the second one by a narrow interval. The succeeding plates are pentagonal with a very obtuse proximal angle, which, beyond the disk, is so widely open that it almost reaches 180°; the lateral sides are divergent and widely excavated by the tentacular pores; they join by acute angles the distal side which is very wide and strongly convex and has in its middle a very conspicuous notch. These plates are much longer than wide and they remain separated on the whole length of the arms by an interval which by degrees grows longer, without, however, becoming as important as on the upper face.

The little protruding side plates bear four fine, cylindrical, elongated, and pointed spines which are more or less divergent and set apart from the arm; the length of these spines increases from the first ventral which is a little longer than half the article to the last dorsal which is almost equal to one and a half articles.

The tentacular scales of the brachial pores show the characteristic arrangement of the genus *Ophiotrema*, that is to say, they appear in the shape of very small, fine, and pointed spines arranged on the proximal edge and on the internal or radial edge of each pore; these spines, amounting to five or six on each pore, are seldom preserved integrally; they have not always the same length, and those of the proximal side of the pore are sometimes a little longer than the others.

Connections and differences.—*O. gracilis* evidently belongs to the genus *Ophiotrema* as I have established it. It differs from the single known species, *O. alberti*, in having slender arms and only four brachial spines which are thin and elongated, much longer and finer than in *O. alberti* where they amount to five and always remain applied against the lateral faces of the arms. The upper brachial plates are narrower, smaller, and more widely separated; the under brachial plates are longer in *O. gracilis*. The tentacular mouth pore is provided with only two papillæ which are elongated, cylindrical, and pointed, rather spiniform, instead of three short and oval papillæ such as exist in *O. alberti*. The small spines of

the brachial tentacular pores also seem to me longer and more slender than in the latter species.

The single existing sample of *O. gracilis* being smaller than most of the *O. alberti* which I have studied, might induce one to think that some of the differences I mention are due to the youth of the subject. I therefore took pains to compare with the example from the *Albatross* the two specimens which were gathered in 1895 by the *Princesse Alice*, one of which is only 6 mm. across the disk. Now, this young specimen already possesses on the tentacular mouth pore the three characteristic papillæ of *O. alberti* with their usual shape; the brachial spines, amounting to five, are short, fairly thick and always remain applied against the lateral faces of the arms. The differences are absolutely striking between this specimen and my *O. gracilis*. One will also notice that the latter species was dredged from a lesser depth than *O. alberti*.

The drawings which I have published of *O. alberti* being, of course, somewhat schematic, I thought I had better reproduce here some photographs of a specimen from the cruises of the *Travailleur* and the *Talisman* so as to illustrate more fully the differences between the two species (pl. 12, figs. 3, 4).

The form of the two papillæ carried by the tentacular mouth pore in *O. gracilis*, reminds one of the single papilla existing at this place in the genus *Ophiomedeæ*, which I introduced in 1907; but in the latter genus this single papilla is much stronger than in *O. gracilis*, and the other mouth papillæ are but three on each side; the shape and arrangement of the tentacular brachial scales are, besides, quite different in the two genera, and, although *O. gracilis* recalls by some characters the genus *Ophiomedeæ*, there can be no question about the latter belonging to the genus *Ophiotrema*.

OPHIOCAMAX AUSTERA Verrill.

Ophiocamax austera VERRILL (99), p. 60, pl. 6, figs. 1, 1a.

Ophiocamax austera VERRILL (99a), p. 355.

Albatross station 2655. May 2, 1886. Lat. 27° 22' N.; long. 78° 07' 30'' W.; 338 fathoms; gy. s.; temp. 47.5° F. Two specimens.

Albatross station 2656. May 3, 1886. Lat. 28° 08' N.; long. 78° 28' W.; 540 fathoms; for.; temp. 41.2° F. One specimen in very bad condition.

Albatross. Havana; no depth mentioned. Three specimens.

The diameter of the disk varies between 8 and 14 mm.; the specimens are rather well preserved though their arms are almost all broken, and they are quite in accordance with Verrill's description.

OPHIOCAMAX FASCICULATA Lyman.

Ophiocamax fasciculata LYMAN (83), p. 265, pl. 7, figs. 92-94.

Ophiocamax fasciculata KÖHLER (97), p. 360.

Ophiocamax fasciculata KÖHLER (99), p. 67.

Ophiocamax fasciculata KÖHLER (07), p. 316.

Albatross station 2125. Feb. 8, 1884. Lat. 11° 43' N.; long. 69° 09' 30'' W.; 208 fathoms; yl. m. s. bk. sp.; temp. 50.7° F. Several specimens.

Albatross station 2129. Feb. 27, 1884. Lat. 19° 56' 04'' N., long. 75° 48' 55'' W.; 274 fathoms; bu. m. fne. s. Several specimens.

Fish Hawk station 7285. Feb. 19, 1902. Lat. $24^{\circ} 15' 00''$; long. $81^{\circ} 47' 30''$ W.; 306 fathoms; s.; temp. 47.5° F. Several specimens (diameter of the disk, 5–12 mm.).

Fish Hawk station 7286. Feb. 19, 1902. Lat. $24^{\circ} 18' 00''$; long. $81^{\circ} 47' 45''$ W.; 133 fathoms; s.; temp. 53.5° F. Five specimens (diameter of the disk, 8–12 mm.).

OPHIOLOGIMUS SECUNDUS, new species.

Plate 16, figs. 4–5.

Albatross station 2666. May 5, 1886. Lat. $30^{\circ} 47' 30''$ N.; long. $79^{\circ} 49'$ W.; 294 fathoms; gy. s.; temp. 48.3° F. Four specimens.

Type.—Cat. No. 32302, U.S.N.M.

All the examples are small; in the largest one the diameter of the disk is 6 mm., and the arms are 16 mm. long; in the others the diameter of the disk ranges between 3 and 4 mm. The arms number six in the four specimens.

The disk is circular or hexagonal with rounded angles. The upper face is covered with extremely thin and transparent plates, which are small, rounded, imbricated, and of a uniform size, both at the center and at the margin, without the slightest indication of primary plates.

There are radial shields which are not very conspicuous, although notably larger than the adjacent plates; they are triangular, elongated, one and a half times or even twice longer than wide, and broadly separated by four or five rows of plates. The plates of the upper face of the disk extend a little over on the arms, but not so far as in *Ophiologimus hexactis* H. L. Clark.

The under face of the disk displays a covering of plates which are identical with those of the upper face and altogether uniform; these plates extend as far as the mouth shield. The genital plates are thin, elongated, and not very apparent. The genital slits are large and broadly open.

The middle-sized mouth shields have a triangular chief portion and a widened distal lobe, which protrudes more or less into the interradial space; the proximal angle is obtuse, rounded, and limited by two sides also rounded; these shields are almost as long as wide. The adoral plates are narrow and elongated; they are a little widened in their internal part, where they lean against each other along the interradial median line, and they are still more widened outwardly, so as to separate broadly the mouth shield from the first lateral brachial plate. The oral plates are triangular and very high. The oral papillæ, which amount to seven or eight on each side, are very small, narrow, and conical; however, the two external papillæ, which correspond to the oral tentacular pore, are somewhat larger; the odd tooth papilla is a little more elongated than the others. Another somewhat elongated and conical papilla starts from the angle of the adoral plate and the first under brachial plate, and is directed toward the mouth.

The arms are fairly narrow. The upper brachial plates, which are middle-sized, are triangular, with a proximal angle and a convex distal side; they are almost as long as wide and separated from one another from the bases of the arms.

The first under brachial plate is rather large, lozenge-shaped, and a little wider than long, with a fairly open proximal angle, which is limited by two straight sides, and a rounded distal angle, also limited by two straight sides. The succeeding plates become much longer than wide, with a proximal angle, which is first

truncated, but becomes sharper and sharper, slightly diverging lateral sides, which are excavated by the large tentacular pores, and a wide and convex distal side. They remain contiguous on almost the whole length of the arms, owing to their proximal angle becoming elongated, but they finally get separated.

The lateral plates bear three fairly wide spines which are flattened, with an obtuse point and a rough surface; these spines are equal, and their length is equal to that of the article; the ventral spine is flattened and a little wider than the others.

The fairly large and oval tentacular pores are each provided with a little lanceolate scale.

Connections and differences.—This species really belongs to the genus *Ophiologimus*, which was introduced by H. L. Clark in 1911 for an ophiuran, *O. hexactis*, which also has six arms; the single specimen had been gathered at Suno Saki (Honshu Island, Japan), between 83 and 158 fathoms. The Atlantic species is evidently very closely allied to *O. hexactis*, but it is plainly separated from it by the presence of very distinct radial shields, by the upper face of the disk being covered with scales all over, even in the younger examples, by the dorsal plates of the disk, which extend but very little over the bases of the arms, by the upper brachial plates, which are triangular and as long as wide, and finally by the presence of a single tentacular scale.

H. L. Clark introduced in the diagnosis of the genus *Ophiologimus* the absence of radial shields; therefore, this character ought to be corrected, since these shields exist in the new species.

The discovery in the Atlantic of a second species of the genus *Ophiologimus* is very interesting.

OPHIOCHITON GRANDIS Verrill.

Ophiochiton grandis VERRILL (84), p. 384.

Albatross station 2394. Mar. 13, 1885. Lat. $28^{\circ} 38' 30''$ N.; long. $87^{\circ} 02'$ W.; 420 fathoms; gn. m.; temp. 41.8° F. One specimen.

Albatross station 2395. Mar. 13, 1885. Lat. $28^{\circ} 36' 15''$ N.; long. $86^{\circ} 50'$ W.; 347 fathoms; gy. m.; temp. 44.1° F. One specimen.

Family OPHIOCOMIDÆ.

OPHIOCOMA ALEXANDRI Lyman.

Ophiocoma alexandri LYMAN (65), p. 74.

Ophiocoma alexandri LJUNGMAN (66), p. 329.

Ophiocoma alexandri VERRILL (67), p. 259.

Ophiocoma alexandri IVES (89), p. 177.

Ophiocoma alexandri KÖHLER (07), p. 325.

Albatross station 2824. Apr. 30, 1888. Lat. $24^{\circ} 11' 30''$ N.; long. $109^{\circ} 55'$ W.; 10 fathoms; brk. sh. One specimen.

Diameter of the disk, 8 mm.; length of arms, 55–58 mm.

The sample is of a light brown and rather uniform color; despite its small size it is plainly characterized. The tentacular scales are two in number on the pores of the three and sometimes four first articles.

OPHIOCOMA ECHINATA (Lamarck).

(=*Ophiocoma crassispina* SAY.)

See for bibliography:

- Lyman (82), p. 171.
- Ives (89), p. 177.
- Verrill (99), p. 177.
- H. L. Clark (01), p. 245.
- H. L. Clark (01a), p. 340.
- Verrill (07), p. 327.
- Köhler (07), p. 325.
- Köhler (13), p. 374.

Key West, Florida. Sixteen specimens.
 Indian Key, Florida. Ten specimens.
 Key Vacaas, Florida. Eight specimens.
 Dry Tortugas, Florida. Three specimens.
 Northwest end of St. Martin's Reef, Florida. One specimen.
 Tortugas Reef, Florida. One dry specimen.
 Sand Key, Florida. Four specimens.
 Cape Florida. One specimen.
 Abaco, Bahamas. Eight specimens.
 St. Thomas. One specimen.
 Swan Islands, Caribbean Sea. Sixteen specimens.
 Hungry Bay, Bermudas. One specimen.
 Ascension Island (doubtful locality). One specimen.

OPHIOCOMA PUMILA Lütken.

See for bibliography:

- Lyman (82), p. 171.
- Greeff (82), p. 156.
- Lyman (83), p. 255.
- Ives (89), p. 177.
- Verrill (99), p. 23.
- H. L. Clark (01), p. 245.
- H. L. Clark (01a), p. 340.
- Köhler (07), p. 326.
- Köhler (13), p. 375.

Key West, Florida. One specimen.
 Sand Key Reef, off Key West. Three specimens.
 Dry Tortugas, Florida. Three specimens.
 Clarence Harbor, Bahamas. July 15, 1903. One specimen.
 Abrolhos Islands, Brazil. Two specimens.

O. pumila is known along the North American coast from Florida down to Colon, in the West Indies, and in Brazil. Greeff found it abundantly in San-Thomé Island (Guinea). It is almost always found near the coast, though Verrill records it off Havana at a depth of 200 fathoms. *Ophiocoma scolopendrina* and *Ophiura hexactis* noticed by Duchassaing in the West Indies are *O. pumila*.

OPHIOCOMA RIISEI Lütken.

See for bibliography:

- Lyman (82), p. 171.
 Ives (99), p. 177.
 Verrill (99), p. 23.
 H. L. Clark (01), p. 245.
 Verrill (07), p. 328.
 Kœhler (07), p. 326.
 Kœhler (13), p. 375.

Sand Key, Florida. Two specimens.

Key West, Florida. Several specimens.

Tortugas Reef, Florida. One dry specimen.

New Providence, Bahamas. Six specimens.

Abaco, Bahamas. Two specimens.

Powell's Point, Eleuthera, Bahamas. One specimen

Family OPHIOTHRICIDÆ.

OPHIOTHRIX ANGULATA (Say).

(=*Ophiotrix violacea* LÜTKEN.)

See for bibliography:

- Lyman (82), p. 219.
 Ludwig (82), p. 18.
 Ives (89), p. 178.
 Verrill (99), p. 18.
 H. L. Clark (01), p. 244.
 Verrill (07), p. 327.
 Kœhler (07), p. 330.
 Kœhler (13), p. 375.

Fish Hawk stations 1646-1651. June 4, 1891. Tangier Sound, Chesapeake Bay; 2½ to 13 fathoms; temp. 67.5° to 71° F. Five specimens.

Albatross station 2320. Jan. 17, 1885. Lat. 23° 10' 39" N.; long. 82° 18' 48" W.; 130 fathoms; fne. co. One specimen.

Albatross station 2324. Jan. 17, 1885. Lat. 23° 10' 25" N.; long. 82° 20' 24" W.; 33 fathoms; co.; temp. 79.1° F. One specimen.

Albatross station 2327. Jan. 17, 1885. Lat. 23° 11' 45" N.; long. 82° 17' 54" W.; 182 fathoms; fne. br. s. One specimen.

Albatross station 2357. Jan. 29, 1885. Lat. 20° 19' N.; long. 87° 03' 10" W.; 178 fathoms; wh. co. One specimen.

Albatross stations 2369-2374. Feb. 7, 1885. Lat. 29° 15'-29° 11' 30" N.; long. 85° 32'-85° 29' 15" W.; 64-66 fathoms; fne. gy. s. and r., fne. gy. s., g.; temp. 35° F. Eight specimens.

Albatross station 2758. Dec. 16, 1887. Lat. 6° 59' 30" S.; long. 34° 47' W.; 20 fathoms; brk. sh.; temp. 79° F. Three specimens.

Grampus station 5055. Feb. 16, 1889. Lat. 25° 02' 49" N.; long. 83° 14' W.; 32 fathoms; brk. sh. fne., co. crs. and fne. One specimen.

Grampus station 5073. Feb. 28, 1889. Lat. 25° 23' N.; long. 83° 24' W.; west coast of Florida; 38 fathoms; co. brk. sh. and live bottom. Two specimens.

Grampus station 5080. West coast of Florida; 32 fathoms; light s. brk. sh. One specimen.

Grampus station 5087. Mar. 11, 1889. Lat. $25^{\circ} 44' 32''$ N.; long. $83^{\circ} 10' 15''$ W.; 31 fathoms; fnc. s. sponge. One specimen.

Grampus station 5100. Mar. 18, 1889. Lat. $26^{\circ} 04'$ N.; long. $83^{\circ} 00'$ W.; 26 fathoms; hrd. blk. gr. One specimen.

Fish Hawk station 1649. June 4, 1890. Tangier Sound, Md.; 7 fathoms; sft.; temp. 71° F. Eighteen specimens.

Fish Hawk station 7106. Mar. 28, 1901. Anclote, $12\frac{1}{2}$ fathoms; r. co. s. Four specimens.

Fish Hawk station 7145. Nov. 5, 1901. Lat. $29^{\circ} 30' 50''$ N.; long. $83^{\circ} 41' 40''$ W.; Pepperfish Key, $3\frac{1}{4}$ fathoms; sdy.; temp. 22° C. Three specimens.

Fish Hawk station 7150. Nov. 7, 1901. Deadman's Bay. Lat. $29^{\circ} 35' 20''$ N.; long. $83^{\circ} 56'$ W.; $9\frac{1}{4}$ fathoms; c.; temp. 19.5° C. Six specimens.

Fish Hawk station 7151. Nov. 7, 1901. Deadman's Bay. Lat. $29^{\circ} 43' 40''$ N.; long. $83^{\circ} 49' 45''$ W.; $5\frac{1}{4}$ fathoms; c.; temp. 20.5° C. Nine specimens.

Fish Hawk station 7153. Nov. 7, 1901. Deadman's Bay. Lat. $29^{\circ} 43' 40''$ N.; long. $83^{\circ} 49' 45''$ W.; $5\frac{1}{4}$ fathoms; s. c.; temp. 23° C. One specimen.

Fish Hawk station 7161. Nov. 21, 1901. Pepperfish Key. Lat. $29^{\circ} 18'$ N.; long. $83^{\circ} 37'$ W.; 8 fathoms; rky.; temp. 18° C. Two specimens.

Fish Hawk station 7201. Dec. 6, 1901. Deadman's Bay. Lat. $29^{\circ} 32' 30''$ N.; long. $83^{\circ} 50'$ W.; 9 fathoms; r. c.; temp. 16.5° C. Two specimens.

Fish Hawk station 7215. Jan. 15, 1902. St. Martins. Lat. $28^{\circ} 26'$ N.; long. $83^{\circ} 02' 30''$ W.; $7\frac{1}{2}$ fathoms; rky. c.; temp. 13° C. One specimen.

Fish Hawk station 7231. Jan. 23, 1902. Anclote. Lat. $28^{\circ} 08' 30''$ N.; long. $83^{\circ} 10'$ W.; 10 fathoms; rky. c.; temp. 13.5° C. One specimen.

Fish Hawk station 7253. Jan. 28, 1902. Highland. Lat. $27^{\circ} 55' 30''$ N.; long. 83° W.; 7 fathoms; c. r.; temp. 15.2° C. One specimen.

Fish Hawk station 7271. Feb. 13, 1902. West Channel Entrance to Key West; $7\frac{1}{4}$ fathoms; cor. sand; temp. 20° C. One specimen.

Fish Hawk station 7290. Feb. 24, 1902. Lat. $24^{\circ} 46' 12''$ N.; long. $81^{\circ} 53' 30''$ W.; $10\frac{1}{4}$ fathoms; co.; temp. 19° C. One specimen.

Fish Hawk station 7293. Feb. 24, 1902. Lat. $24^{\circ} 46' 40''$ N.; long. $81^{\circ} 55' 40''$ W.; $10\frac{1}{2}$ fathoms; co.; temp. 20° C. One specimen.

Fish Hawk station 7354. Dec. 17, 1902. Florida Bay; $11\frac{1}{2}$ feet; h. gy. s. sh.; temp. 23.5° C. One specimen.

Fish Hawk station 7390. Dec. 22, 1902. Off Cape Sable, Florida. Lat. $25^{\circ} 01'$ N.; long. $81^{\circ} 25' 30''$ W.; $4\frac{1}{2}$ fathoms; rky. Three specimens.

Fish Hawk station 7511. Mar. 25, 1903. rky. One specimen.

Callibogue, South Carolina. Eight specimens.

Mouth of Bulls Creek, South Carolina. Numerous specimens.

Charleston Harbor, South Carolina. Three specimens.

Cedar Keys, Florida. Very numerous specimens.

Boca Ceiga Bay, Florida. Five specimens.

Sarasota Bay, Florida. One specimen.

Pensacola, Florida. Eight specimens.

Tampa Bay, Florida. One specimen.

N. of St. Martins Reef, Florida. Seven specimens.

Florida. Four specimens.
 Jamaica. One specimen.
 Bahamas. One specimen.
 St. Thomas. One specimen.
 Port Castries, St. Lucia. One specimen.
 Trinidad, shore. One specimen.
 Abrolhos Islands. Nine specimens.

Among the above-mentioned stations, some will be noticed where the depth is fairly great; such is the case with the stations 2369-2374 (66 fathoms), 2320 (130 fathoms), 2357 (178 fathoms), and 2327 (182 fathoms). But it is already known from elsewhere that *O. angulata* may go down fairly deep, and Verrill has reported it at 200 fathoms off Havana. The specimens coming from deeper waters than 100 fathoms are lightly colored, grayish, greenish, or somewhat pink.

The specimens from stations 2369-2374 are very small, and the diameter of their disks ranges between 2.2 and 2 mm. They are greenish-gray, and their brachial spines are fairly large; they offer a superficial likeness to *O. pallida*, of which I have recently given a new description from the only example known up to the present day (13, p. 377). But, after having compared them very carefully with the type of that species, I have satisfied myself that they actually are *O. angulata*; for the radial shields are smaller than in *O. pallida*; the upper and under brachial plates, although fairly elongated as they always are in very young *O. angulata*, are, however, less so than in *O. pallida*; the first under brachial plates, especially, are first a little wider than long, then they progressively grow longer, but they do not become longer than wide until within a certain distance from the disk; lastly, the first ventral spine changes into a hook only at a fairly great distance from the basis of the arms.

The young *O. angulata* always have their under and upper brachial plates longer than those of the adults, and dorsal spines which become very much elongated in the terminal part of the arms.

OPHIOTHRIX LINEATA Lyman.

Ophiothrix lineata LYMAN (61), p. 201.
Ophiothrix lineata LYMAN (65), p. 171.
Ophiothrix lineata LJUNGMAN (66), p. 171.
Ophiothrix lineata LJUNGMAN (71), p. 654.
Ophiothrix lineata LYMAN (78), p. 233.
Ophiothrix lineata IVES (89), p. 178.
Ophiothrix lineata KÖHLER (97), p. 334.
Ophiothrix lineata KÖHLER (13), p. 376.

* *Fish Hawk* station 7124. Apr. 2, 1901. Lat. 25° 50' 15" N.; long. 82° 41' 45" W.; 21 fathoms; sandy; temp. 20° C. Eight specimens.

Fish Hawk station 7177. Nov. 27, 1901. North Key. Lat. 29° 05' N.; long. 83° 22' 30" W.; 5½ fathoms; sdy. rky. c.; temp. 15.5° C. One little specimen.

Fish Hawk station 7373. Dec. 19, 1902. Florida Bay; sp. s. sh.; temp. 23° C. Two specimens.

Fish Hawk station 7429. Jan. 7, 1903. ½ mile SE. by S. of SE. end of Duck Key; 14 feet; rky. Three specimens.

Biscayne Bay, Florida. One specimen.

OPHIOTRICH GERSTEDII Lüken.

See for bibliography.

Lyman (82), p. 226.

Ives (89), p. 178.

H. L. Clark (01), p. 244.

Köehler (07), p. 336.

Köehler (13), p. 376.

Fish Hawk station 7108. Mar. 28, 1901. Right Channel into Tampa Bay; 12½ fathoms; br. sh. and s.; temp. 19.1° C. One specimen.

Fish Hawk station 7428. Jan. 27, 1903. 1 mile N. N. W. ½ W. of East Washerwoman; 16 feet; rky. One specimen.

Fish Hawk station 7467. Feb. 19, 1903. Grecian Shoals. One specimen.

Key West, Florida. Numerous specimens.

Indian Key, Florida. Five specimens.

Bird Key, Florida. Thirteen specimens.

Tortugas, Bird Key Reefs, Florida. Nine dry specimens.

Dry Tortugas, Florida. Several specimens.

Ragged Key, Florida. One specimen.

Florida. Two dry specimens.

Key Largo, Florida. One specimen.

Nassau, Bahamas. Three specimens.

Golding Key, Bahamas. One specimen.

Green Cay, Bahamas. One specimen.

OPHIOTRICH SUENSONII Lüken.

See for bibliography:

Lyman (82), p. 222.

Ives (89), p. 178.

Verrill (99), p. 21.

H. L. Clark (01), p. 244.

Verrill (07), p. 327.

Köehler (07), p. 338.

Köehler (13), p. 376.

Albatross station 2409. Mar. 18, 1885. Lat. 27° 04' N.; long. 83° 21' 15" W.; 26 fathoms; crs. gy. s. brk. sh. One specimen.

Albatross station 2649. Apr. 12, 1886. Lat. 23° 34' N.; long. 76° 33' W.; 36 fathoms; co. s.; temp. 74.2° F. Seven specimens.

Fish Hawk station 7182. Nov. 28, 1901. Deadmans Bay. Lat. 29° 32' 30" N.; long. 83° 50' W.; 9 fathoms; rky. c.; temp. 15.3° C. Three specimens.

Fish Hawk station 7211. Dec. 9, 1901. North Key. Lat. 28° 47' 55" N.; long. 83° 16' 30" W.; 8 fathoms; rky. grsy.; temp. 17° C. Five specimens.

Fish Hawk station 7215. Jan. 15, 1902. St. Martins. Lat. 28° 26' N.; long. 83° 02' 30" W.; 7½ fathoms; rky. c.; temp. 13° C. Eleven specimens.

Fish Hawk station 7216. Jan. 15, 1902. Lat. 28° 26' 30" N.; long. 83° 08' W.; 10 fathoms; sdy. grsy.; temp. 13.6° C. Two specimens.

Lat. 28° 42' N.; long. 83° 30' W. Two specimens.

Key West, Florida. Manship Channel. One specimen.

West Coast of Florida. One specimen.
Bahamas. Twenty-two specimens.
Belize, British Honduras. One dry specimen.
Bermudas. Two specimens.
Green Cay, Bermudas. One specimen.

OPHIOTHRIX CONVOLUTA, new species.

Plate 16, figs. 1 and 6.

A specimen found on a branch of *Acanthogorgia fusca*, without any indication of locality.

Type.—Cat. No. 32303, U.S.N.M.

The diameter of the disk reaches 6 mm.; the arms are strongly convoluted and their length must have exceeded 45 mm.

The disk is subpentagonal. The upper face offers, between the radial shields, a covering of rounded and very unequal plates, some of which are small and comparatively few, the others rather large. The former are unarmed or each of them carries only a little short and thick stump, the others, on the contrary, are provided with a very strong spine which is thick, elongated, and bears, on its edges, strong, sharp, and approximated denticulations. These spines vary in length, but most of them reach, or even exceed, one millimeter. They are numerous and dense in the central region of the disk and in the interradial spaces. These spaces are very broad, while the radial spaces, narrow between the two shields of each pair, give the appearance of as many very narrow triangles, which separate the shields on one-half or two-thirds of their length. The plates which cover these interradial spaces are small, and they carry only short stumps or even remain absolutely bare. The fairly large radial shields are triangular and their length exceeds half the radius of the disk; they are twice and a half longer than wide and their radial side is about straight, while the interradial side is strongly convex; their surface is absolutely deprived of spines and covered with minute granules. The two shields of each pair are little diverging; they are contiguous outwardly for a variable length and they are inwardly separated by the narrow radial areas which I have mentioned above.

The plates of the upper face and the large spines on them cease at the edge of the disk and the under face is almost completely bare; there are only in the interradial areas a few scarce and isolated plates which are not often seen except at the outline of the disk and each of which bears a small stump. The genital slits and plates are broad and well developed.

The middle-sized mouth shields are triangular, with a slightly sharp proximal angle which is limited by straight sides, and a very convex distal side; the latter is sometimes broken up into two sides, which gives to the shields a lozenge-like appearance; in one of them the proximal angle is separated from the rest of the plate by a fissure. These shields are as long as wide, or even a little longer than wide; the shield which carries the madreporic pore is very large, oval, and much longer than wide. The adoral plates are small, triangular, hardly contiguous on the median interradial line by their rounded apex. The papillæ of the external sets are elongated, fairly large, conical, and pointed; the others, located within the foregoing ones, are much smaller.

The upper brachial plates are very large, quadrangular, with a narrow proximal side, a very wide distal side, meeting by sharp angles the lateral sides which are divergent. The distal side is rather concave on the first plates, then it becomes convex and it finally resolves itself into two small sides which are united by a very obtuse and rounded angle, behind which the surface of the plate offers a very small obtuse protuberance; these plates are never much wider than long, and sometimes they are as wide as long. The shape of the plates in the first half of the arms does not appear very plainly, for the said plates are almost always more or less strongly divided into fragments which, in certain regions, are so many that the limits between the successive plates are no longer distinct; then the fragments become fewer when the plates are only divided into two or three parts, and finally they remain simple up to the end of the arms. This dividing up exists, besides, in very variable degrees according to which arms are examined, and on one of them it is less conspicuous than on the others. The specimen being single, it is impossible to tell whether this dividing constitutes a specific character or is accidental; none of the arms show any trace of regeneration.

The under brachial plates are absolutely invisible, and they are covered up by the teguments.

The brachial spines amount to six only, and they are not very much developed. The first one is very short and thin; the second one is notably longer and stronger; and then the length progressively increases up to the fifth one, which is hardly larger than the corresponding article; the last dorsal spine is a little shorter than the foregoing one. The relative length of these spines increases a little in the second half of the arms. These spines are bare, flattened, fairly wide, with rounded ends, and they are provided on their edges with pretty strong denticulations, which are conical, somewhat unequal, lying close to one another on the ventral spine, but more loosely arranged on the last two dorsal spines, where, besides, they are less conspicuous. The first ventral spine changes into a hook near the fifteenth article.

There is not the slightest trace of a tentacular scale, which is probably hidden by the tegument.

Connections and differences.—*O. convoluta* recalls certain forms of *O. fragilis*, but I thought I ought to separate it specifically, owing to the disk armature, to the shape of the mouth shields, as well as to the peculiar characters displayed by the upper brachial plates, and also owing to the shape of the arms, which are wrapped around on themselves. I know among *O. fragilis* no form in which the spines of the upper face are so much developed and appear so thick on a disk having such a comparatively small diameter, while, on the contrary, the armature of the under face of the disk is extremely reduced and almost nonexistent. The upper brachial plates, instead of showing a more or less conspicuous distal angle, which is often upturned in the shape of a protruding beak, are rather quadrangular with a slightly convex distal side and they are not much wider than long. The shape of the mouth shields is also rather peculiar, since they are almost lozenge-shaped and as wide as long. As to the very curious dividing up displayed by the upper brachial plates in the first part of the arms, it is not safe to dwell on it, for it is perhaps an individual feature, but this seems to me most doubtful.

Family OPHIOSCOLECIDÆ.

OPHIOSCOLEX GLACIALIS Müller and Troschel.

See for bibliography:

Köhler (09), p. 198.

Grieg (10), p. 6.

Mortensen (10), p. 274.

Süssbach and Breckner (11), p. 259.

Albatross station 2092. Sept. 20, 1883. Lat. $39^{\circ} 58' 35''$ N.; long. $71^{\circ} 00' 30''$ W.; 197 fathoms; gn. m.; temp. 45° F. One specimen.

The upper face of the disk has been torn away, but the rest of the specimen is in a very good condition and is perfectly well characterized. The diameter of the disk must have been from 22 to 24 mm. The specimen is quite in conformity with those of the European seas with which I have been able to compare it. Certain articles of the bases of the arms exceptionally carry four spines, but I observe the same peculiarity in some examples from the Norwegian coasts. There can be no possibility of confusing this specimen with *O. quadrispinus* Verrill, which was found in Nova Scotia, and which is at once distinguishable from *O. glacialis* through the presence of a tentacular scale.

An individual in a very bad state, from stations 2582-83 and associated with numerous *Ophiocten hastatum* and *Ophioglypha sarsii*, undoubtedly belongs to the same species.

OPHIOLEPTOPLAX ATLANTICA, new species.

Plate 15, figs. 6-7.

Albatross station 2659. May 3, 1886. Lat. $28^{\circ} 32'$ N.; long. $78^{\circ} 42'$; 509 fathoms; br. for.; temp. 45.2° F. One specimen.

Type.—Cat. No. 32304, U.S.N.M.

The specimen is, unfortunately, incomplete and the upper face of the disk has been completely torn away; judging by the traces left on the upper face of the arms, the diameter of the disk must have been 12 mm. or thereabout. The diameter of the circle formed by the external sides of the mouth shields is 5.5 mm. The arms are incomplete and the longest is preserved to a length of only 30 mm.; they are flattened and about 2.5 mm. wide.

The mouth shields, which are not very large, are triangular, wider than long, with an obtuse proximal angle and a convex distal side. The adoral plates, large and wide, are extremely elongated and four or five times longer than wide, but their edges are not absolutely parallel; they are, in fact, somewhat widened in their internal third part, become narrower at the level of the oral tentacular pore, which is very large, and then grow a little wider again outwardly, where they broadly separate the mouth shield from the first lateral brachial plate. The oral plates are large, fairly wide, and elongated; on their free edges each of them carries four rather large, conical, and pointed papillæ, lying fairly apart from one another; the most external of these is located near the oral tentacular pore and is longer than the others. The teeth and the tooth papillæ are shaped like the mouth papillæ; they are not all preserved, but they seem to me to amount to five; three are found on a lower level and represent especially tooth papillæ, the other two, larger, are superposed and they correspond to two teeth. The mouth pieces are covered with fine granulations, rounded and loosely placed.

The upper face of the arms is covered with a set of large lamellæ, each of which undoubtedly represents an upper brachial plate. These lamellæ are very large, quadrangular, wider than long, and widened on their distal side, which is slightly rounded; the lateral sides are slightly divergent. Their surface displays extremely fine lines bounding hexagonal fields which are very dense and minute. These lamellæ are exceedingly thin and completely transparent, so that they allow the underlying parts to be seen, the color of which is white above the vertebra and brownish above the muscles.

The first brachial under plate is large, oval, and transversely widened. The following ones are quadrangular, longer than wide, their proximal edge being straight and narrower than the distal side which is broad and convex; this side most generally shows three distinct little lobes; the lateral sides are divergent and rather strongly excavated by the corresponding tentacular pores, which are very large. From the sixth plate upward the proximal side is replaced by an acute and elongated angle; the plates are then no longer contiguous, and, at the same time, they become much narrower in their middle region, owing to the extension of the tentacular pores, their distal side remaining still very wide and trilobed.

The tentacular pores are very large, rounded, and deprived of scales, excepting the oral pores which are each provided, on their interradian edge, with three conical and elongated papillæ which are inserted near the end of the adoral plate; the external papilla is even remarkable by its elongation and it constitutes an actual spine.

The lateral plates, slightly protruding, carry each three subequal spines, the length of which equals that of the article; these spines have rounded ends and their surface microscopically appears covered with very fine, conical, and dense rugosities.

Connections and differences.—The Ophiuran which I have just described seems to me to fit perfectly in the genus *Ophioleptoplax* recently introduced by H. L. Clark (11, p. 278). The type of this genus is *O. megapora*, which was discovered by the *Albatross* in the Japanese seas at lat. $32^{\circ} 26' N.$ and long. $129^{\circ} 27' 30'' E.$, at a depth of 71 fathoms. The new species differs from it in having larger mouth shields, much more elongated adoral plates, more developed mouth and tooth papillæ, in having papillæ on the tentacular oral pores, and, lastly, in having much more elongated under brachial plates.

OPHIOBYRSELLA QUADRISPINOSA, new species.

Plate 16, figs. 2-3.

Albatross station 2343. Jan. 19, 1885. Lat. $23^{\circ} 11' 35'' N.$; long. $82^{\circ} 19' W.$; 279 fathoms; fne. co. Two specimens.

Type.—Cat. No. 32305, U.S.N.M.

The diameters of the disks are respectively 19 and 22 mm.; the arms are exceedingly long, very sinuous, and their length exceeds 170 mm. in the larger specimen.

The disk is pentagonal with rounded angles. The upper face is covered with a bare tegument which is deprived of plates and spines and shows only a few dense and irregular folds. However, in the vicinity of the radial shields and at the margin

of the disk, the folds disappear, the tegument becomes thinner though offering at the same time a few small rounded plates, well separated from one another, and very weakly developed. In the interval which separates the two radial shields of each pair, these plates appear at the height of the middle of the shields; they are at first small and loosely spread, and then they grow larger as the base of the arms is nearer; they even extend to the upper face of the arms on which they very soon disappear. On either side of the radial shields there are also to be found in the interradian spaces some plates which are small and scarce; these plates, besides, appear only near the very edge of the radial shields. These shields are strongly developed. Each of them constitutes an elongated and narrow plate, forming a fairly thick protuberance which is wider distally than proximally, and the length of which equals about half the radius of the disk. The two shields of each pair are far apart and the interval between them is almost equal to the width of the arm; they are directed almost parallel to each other. Every one of these shields is armed with a row of strong, elongated and sharp spines, which are shorter and more dense toward the proximal end of the shield, where they sometimes form two parallel rows. The little plates, which are near the radial shields, are absolutely unarmed.

The under face of the disk in the interradian spaces is bare; the tegument which covers it is smooth, thin, and transparent. There are, however, near the genital slits, a few small, rounded and scattered plates which become a little more dense, and larger, as they come nearer the mouth shield. The genital slits are very conspicuous; the genital plates are wide and quite distinct.

The outlines of the mouth pieces are not very distinct, owing to the tegument which covers them. The mouth shields, which are rather small, are pentagonal, a little longer than wide and a little narrower proximally than distally; they offer an obtuse proximal angle, limited by two straight or slightly excavated sides; the lateral sides are straight and converging, the distal edge is narrow. The elongated and narrow adoral plates are slightly incurved in the shape of a crescent with parallel sides; they are three and a half times longer than wide. The oral plates are well developed, triangular, and very high. As a rule, there are on each side three oral papillæ which are strong, conical, blunt-pointed, and have a very rough surface. Besides, there are three or four tooth papillæ of the same shape as the foregoing ones, but stronger, and generally arranged in two superposed pairs.

The arms are of medium breadth and the upper face is convex. The upper brachial plates do not exist. The slight, almost imperceptible calcification of the teguments, which is observed at the basis of the arms and which appears in the shape of small, very thin and rounded plates, which are analogous to those existing between the radial shields, does not go beyond the second article.

The first under brachial plate is large, trapezoidal, wider than long, with a proximal edge which is wider than the distal edge toward which the lateral sides converge. The following plates are pentagonal, large, much wider than long, with a truncated proximal angle, short lateral sides which are excavated by the tentacular pores, and a rounded distal side which sometimes shows in its middle a very small notch. All these plates are contiguous.

The lateral plates, which are very broad, carry each four spines, which are thin, pointed, flattened, transparent, and provided over their whole length with fairly strong denticulations; their length increases from the first ventral spine, which is equal to one and a half articles, to the third one, which is equal to two articles; the last dorsal spine is a little smaller.

The tentacular pores are large, oval, and transversely widened; there is no tentacular scale.

Connections and differences.—*O. quadrispinosa* is allied chiefly to *O. hystericis* (Lyman), and it recalls more particularly the example of that species which Bell represented in 1892.¹ But it is at once distinguished from it by the absence of spines on the upper face of the disk out of the radial shields and by the brachial spines being larger and fewer. *O. serpens* (Lyman) has but three brachial spines which are strongly echinulated, not much covered by the tegument, and unequal.

By the shields on its upper face and by the small number of spines this new Ophiuran very much resembles *Ophiophryxus acanthinus*, which has recently been described by W. K. Fisher, from a single specimen found in Japan between 94 and 150 fathoms; but it differs from it in the mouth pieces and, besides other things, in the height of the oral plates and the development of the oral papillæ, as well as in the shape of the under brachial plates; it really belongs to the genus *Ophiobyrsella*, selected by Verrill out of the genus *Ophiobyrsa*.

Family OPHIOCHONDRIDÆ.

OPHIOCHONDRUS GRANULATUS, new species.

Plate 14, figs. 1, 4-5.

About 15 specimens, found on branches of *Platycaulis danielsseni*, without any indication of locality.

Type.—Cat. No. 32306, U.S.N.M.

The diameter of the disk may reach 7 mm., and in several specimens it varies between 5 and 6 mm.; the others are smaller. The arms are more or less rolled up in a vertical plane, and it is difficult to exactly estimate their length; it is about 25 mm. in some specimens, the disk of which is 5 mm. wide.

The disk is pentagonal, more or less excavated in the interradial spaces; it is, besides, excavated at the bases of the arms between the two radial shields of each pair. The upper face is slightly convex and depressed in the central region while the radial shields are protruding. This upper face lies on a higher level than that of the bases of the arms. It is provided with plates which are covered up by a thin tegument, which, however, allows the limits of the plates to be seen on the dry specimens. These plates are rounded, small, subequal, somewhat imbricated, chiefly near the outline of the disk. Each of them bears in its middle a large cylindrical stump which is short and thick, with a rounded end armed with rather strong, short, pointed and unequal spinules which extend over on the sides of the stump, at the same time as they become much smaller, thus making the said sides very rough. The radial shields are quite apparent; they are elongated, protruding,

¹ On the classification of Ophiurids, 1892, pl. 12, figs. 2, 3.

triangular, with a rounded proximal angle; they are twice and a half longer than wide and their length is about equal to half the radius of the disk. These shields are absolutely bare and their surface is deprived of stumps, except near the external edge, which may show two or three. The two shields of each pair are parallel to one another, and they are widely separated by two or three rows of plates. The under face of the disk is covered with small, imbricated, equal plates, the outlines of which are fairly distinct, and which may each carry a little elongated and conical granule. These granules appear chiefly near the outline of the disk, but they do not occur, however, until near the radial shields, chiefly on the larger samples. The genital slits are wide and very conspicuous and extend from the margin of the disk to the mouth shields.

These shields are much wider than long, with a very obtuse and rounded proximal angle, which is limited by two slightly incurved sides; the lateral angles are more or less thin and sharp; the distal side is convex and forms a lobe more or less protruding into the interradiar space. According to the respective forms of this distal lobe and of the proximal angle, the shields are either triangular, which is the most frequent case, or lozenge-shaped. The rather large adoral plates are thick, two and a half times longer than wide, and bent in the shape of a crescent; they are narrower toward their distal end. The oral plates are triangular and rather small. The oral papillæ generally amount to four and are arranged in a regular row; they are rather thick and covered with sharp denticulations, which are very small and dense; the two internal papillæ are narrow and the two external ones are more widened. To these papillæ are sometimes added two smaller ones which are intercalated between the former. The odd terminal papilla is larger than the others, wide, rounded, and rough.

The upper brachial plates are fairly large, triangular, with a rounded proximal angle and a convex distal side; they are a little wider than long and they sometimes become a little campanuliform; from the second one upward, they are separated by a very wide interval. One meets sometimes on the first three or four articles a little rounded supernumerary plate at the base of the chief dorsal plate, but I do not observe this character except on the largest specimen, and I think it is due to age; it is important to note that neither the young nor the middle-aged ones show any indication of it.

The first under brachial plate, which is rather large, is a little longer than wide, its proximal side being larger than its distal side. The four or five succeeding plates are large, very much widened, wider than long, triangular, with a very obtuse proximal angle and a strongly convex distal side. The width of the under plates then decreases progressively and they very soon become as long as wide; at the same time, they assume a pentagonal shape with two distinct lateral sides and a rounded distal side; they are broadly separated from each other from the second one upward.

The protruding lateral plates carry five spines each. The first two ventral spines are shorter than the article; the third one is almost as long as the article, the fourth is larger, and the fifth reaches about one and a half articles. These spines are strong and thick, cylindrical, with an obtuse and rounded end, except

on the last dorsal spine which is more pointed than the others; their surface is very rough and it even offers very small and dense denticulations which are somewhat unequal. The brachial spines stand perpendicular to the longitudinal axis of the arm, and they do not lie at all on the lateral plates.

The single tentacular scale is small, conical, with a blunt point; it is often hidden under the first ventral spine. The examples in alcohol are brownish-yellow.

Connections and differences.—Owing to the arms being rolled up in a vertical plane, and to their being inserted under the upper face of the disk, owing also to several other characters, this species evidently belongs to the genus *Ophiochondrus*, as it has been restricted by Verrill, and from which must be excluded *O. squamosus*, which forms the type of the genus *Ophiochondrella*. The new species which I have just described will easily be distinguished from the already known species by the following characters: *O. convolutus* Lyman possesses six spines and the disk is covered with numerous granules, which are very small and dense. *O. crassispinus* Lyman also has its disk covered with very small granules, the radial shields are very large, and the spines amount to seven or eight. *O. gracilis* Verrill is a small species, the diameter of the disk of which does not exceed 3 mm.; the characters of the upper face of the disk are unknown, but the brachial spines amount to eight. Lastly *O. stelliger* Lyman has its disk covered with minute granules, and the brachial spines amount to four only.

Among the Ophiurans gathered by the *Princesse Alice*, I described under the name of *Ophioplus armatus* (07, p. 46, and 09, p. 203) an Ophiuran which was represented by two specimens only and which I have found again among the forms dredged by the *Albatross*. After a review of that species by the examination of more numerous specimens and a comparison with *Ophiochondrus granulatus*, it seems to me more correct to classify this Ophiuran also in the genus *Ophiochondrus*. I was tempted to place it in the genus *Ophioplus* owing chiefly to the state of the upper brachial plates, which are divided up, but it may be seen by the description of *O. granulatus* that this character may appear also in the genus *Ophiochondrus*. Moreover, the shape of the genital slits excludes from the genus *Ophioplus* the species from the *Princesse Alice*. Now the *O. granulatus* which I have just described is very closely allied with *O. armatus*; I shall discuss the differences which separate these two species, after having described the specimens of *O. armatus* gathered by the *Albatross*.

OPHIOCHONDROS ARMATUS (Köhler).

Plate 14, figs. 2-3, 6.

Ophioplus armatus KÖHLER (09), p. 203, pl. 38, figs. 7, 8.

Albatross station 2415. Apr. 1, 1885. Lat. 30° 44' N.; long. 79° 26' W.; 440 fathoms; co. crs. s. sh. for.; temp. 45.6° F. Two specimens.

Albatross station 2645. Apr. 9, 1886. Lat. 25° 46' 30'' N.; long. 80° 02' W.; 157 fathoms; gn. s.; temp. 43.4° F. Two specimens.

Albatross station 2663. May 4, 1886. Lat. 29° 39' N.; long. 79° 49' W.; 421 fathoms; br. s.; temp. 42.7° F. One specimen.

Albatross station 2667. June 5, 1886. Lat. $30^{\circ} 55' N.$; long. $79^{\circ} 42' 30'' W.$; 273 fathoms; gy. s. bk. sp.; temp. $48.7^{\circ} F.$ One specimen.

Albatross station 2668. June 5, 1886. Lat. $30^{\circ} 58' 30'' N.$; long. $79^{\circ} 38' 30'' W.$; 294 fathoms; gy. s. dd. co.; temp. $46.3^{\circ} F.$ Three specimens.

All the specimens are very small and the diameter of the disk ranges between 2.5 and 5 mm. They agree with the two specimens which the *Princesse Alice* gathered in 1902 at latitude $36^{\circ} N.$ and longitude $26^{\circ} W.$, but as the arms of the latter, which were, besides, mostly incomplete, were not at all or very little rolled up, I referred these two specimens to the genus *Ophioplus*, taking as a basis chiefly the division of the upper brachial plates. A study of the specimens from the *Albatross*, which are more numerous and better preserved than those of the *Princesse Alice*, and above all, a comparison with the species I have just described under the name of *Ophiochondrus granulatus*, have permitted my settling the generic position of *O. armatus*, and completing on several points my former description.

The disk is more or less strongly excavated in the interradii spaces. The upper face is generally depressed in its center as well as in the interradii, while the radial parts are protruding, and at the margin of the disk they are placed on a higher level than that of the insertion of the arms. There are sometimes to be seen radial ribs which succeed the radial shields toward the center of the disk, but this arrangement is not constant. The upper face of the disk is covered with thin imbricated plates, with very plain outlines; each of these plates shows a granule which is now short and rounded, now a little elongated, but which as a rule is not very high in the American specimens; these granules are generally rather scattered and their surface is smooth. However, in the sample from station 2667, they are more numerous and stronger and are elongated into small conical stumps the end of which bears a few spinules which are extremely short. But these elongated granules hardly deserve the name of spines. On the two examples from the *Princesse Alice*, these stumps, which are rather numerous, are more elongated than on the American specimens; they may be conical and pointed, or their end may be obtuse and provided with a few spinules, but I must say that they are less elongated than shown in the drawings which I published in 1909, and where, in spite of my corrections, their length remained exaggerated. On all the specimens, I perceive radial shields, but these are small, very broadly separated and they have on their margin a few granules.

The under face of the disk is covered with distinct, rounded, nonimbricated plates, which bear, chiefly near their margins, granules or small spines which sometimes extend as far as the mouth shields. The genital slits extend as far as the margin of the disk.

The mouth shields are triangular, wider than long, with more or less conspicuous lateral angles, which sometimes are but slightly rounded; the distal side is always very convex on the American examples, and it shows in its middle a little lobe which is fairly well marked. The adoral plates, which are crescent-shaped, are generally less thick than on the two specimens from the *Princesse Alice*.

The oral papillæ amount to only three on all the American specimens, and only on the two specimens of the *Princesse Alice* do they reach the figure four, which I have again ascertained. The odd dental papilla is large and thick.

The brachial articles are elongated. The upper brachial plates do not show in the American specimens such a marked division as in the two types. Only on two specimens from station 2668 and on that from station 2667, where the diameter of the disk reaches 5 mm., do I observe this dividing, which is limited to the first two or three dorsal brachial plates; each of these plates offers a triangular chief portion with a truncated proximal angle and a proximal fragment which is larger on the first article, but very small on the following ones, where it is reduced to a small circular plate. The other upper plates are always whole; generally, there is left between their proximal angle and the distal margin of the preceding plate, a little space covered by the tegument and which is never beset by a plate. The dorsal brachial plates always remain a little longer than wide, and their proximal angle is rounded.

The first under brachial plate is large, trapezoidal, longer than wide. The following ones are pentagonal, but in the American examples, they are comparatively smaller than on my 1909 drawing, and they get separated beyond the second one; they are at first a little wider than long.

The lateral plates, very much elongated owing to the length of the articles, carry five short, thick spines which are beset with strong spinules in their terminal part; these spines do not exceed half the article, except the last dorsal one which is a little longer. These spines always remain more or less closely applied against the lateral plates.

I had not noticed the tentacular scale in 1909. There is really one such scale, but it is very small, more or less buried in the tegument and very difficult to recognize; I have been unable, besides, to notice it on all the articles; it is spiniform.

I have said above that *O. granulatus* is very near *O. armatus*, and one might first suppose that the latter is but a young stage of the former, but it is not so and it is easy to grasp the differences which separate the two species. The most obvious is supplied by the brachial spines which are much longer in *O. granulatus* and which, instead of being applied against the lateral plates, are on the contrary, off-standing and diverging from them. The upper plates of the disk, which are larger and less numerous than in *O. armatus*, are beset with strong and thick granules, provided with strong spinules which never get elongated into small, conical spines, but always remain cylindrical, and almost as long as wide. The dorsal brachial plates show no dividing up, except on the first two or three brachial articles, and they are much wider than long; lastly, the brachial articles are shorter. The oral papillæ may become fairly numerous in *O. granulatus*, and in the large specimens they may amount to six or seven. It seems also that *O. armatus* always remains rather small, while the dimensions of *O. granulatus* are great.

The differences which I have just indicated appear plainly when specimens of equal size are compared, such as a little specimen of *O. granulatus* which I have represented on plate 14, figure 4, compared with the examples of *O. armatus* reproduced on the same plate.

Family OPHIOMYXIDÆ.

OPHIOMYXA FLACCIDA (Say).

See for bibliography:

Studer (83), p. 29, pl. 3, fig. 14.

Ives (89), p. 178.

Verrill (99), p. 65.

H. L. Clark (01), p. 340.

Kœhler (07), p. 441.

Verrill (07), p. 329.

Kœhler (13), p. 379.

Key West, Florida. Thirteen specimens.

Tortugas, Florida. Three specimens (one dry).

New Providence, Bahamas. Two specimens.

Santa Lucia. One specimen.

St. Thomas. One dry specimen.

O. flaccida is widely spread along the coasts of Florida down to Brazil, in the West Indies, Bermudas, etc.

OPHIODERA STIMPSONII (Lyman).

Ophioscolex stimpsonii LYMAN (75), p. 23, pl. 1, figs. 11-15.

Ophioscolex stimpsonii LYMAN (82), p. 234.

Ophiiodera stimpsonii VERRILL (99), p. 67, pl. 2, figs. 4-4a.

Albatross station 2146. Apr. 2, 1884. Lat. $9^{\circ} 32' N.$; long. $79^{\circ} 54' 30'' W.$; 34 fathoms; brk. sh. One specimen.

Albatross station 2663. May 4, 1886. Lat. $29^{\circ} 39' N.$; long. $79^{\circ} 49' W.$; 421 fathoms; br. s.; temp. $42.7^{\circ} F.$ One specimen.

Albatross station 2668. May 5, 1886. Lat. $30^{\circ} 58' 30'' N.$; long. $79^{\circ} 38' 30'' W.$; 294 fathoms; gy. s. dd. co.; temp. $46.3^{\circ} F.$ Two specimens.

Albatross station 2753. Dec. 4, 1887. Lat. $13^{\circ} 34' N.$; long. $61^{\circ} 03' W.$; 281 fathoms; bk. s.; temp. $48^{\circ} F.$ One specimen.

The diameter of the disk reaches 18 mm. in the specimen from station 2663 and in one of the two from station 2668; the one from station 2753 is smaller (diameter of the disk 13-14 mm.). The second specimen from station 2668 is small and in a bad state of preservation. The arms of the larger examples are from 75 to 85 mm. long.

The brachial spines generally amount to three, a figure indicated by Lyman; there is sometimes an alternation between three and four spines, as indicated by Verrill, or between two and three. The oral papillæ number three on the specimen from station 2753, and three or four in the others; on the first specimen, they show a regular shape with the free edge finely denticulated, as stated by Verrill; in the others, they are more irregular.

Family HEMIEURYALIDÆ.

SIGSBEIA CONIFERA, new species.

Plate 14, fig. 7; plate 17, fig. 6.

Albatross station 2167 (type locality). May 1, 1884. Lat. $23^{\circ} 10' 40''$ N.; long. $82^{\circ} 20' 30''$ W.; 201 fathoms; co. One specimen.

Albatross station 2330. Jan. 17, 1885. Lat. $23^{\circ} 10' 48''$ N.; long. $82^{\circ} 19' 15''$ W.; 121 fathoms; fne. gy. co. One specimen.

Type.—Cat. No. 32307, U.S.N.M.

Both specimens were fixed on branches of *Stylaster filigrana*.

I think we ought to refer to this species the small example described by Verrill under the name of *Sigsbeia murrhina* (91, p. 72, pl. 2, figs. 1, 1a); indeed the smaller of my two specimens is almost identical with it.

In the larger sample, which comes from station 2167, the diameter of the disk is 5 mm., and in the smaller, it exceeds 3.5 mm.; the arms are more or less rolled up and it is difficult to appreciate their length, especially in the larger specimen; in the smaller one, they are hardly one centimeter long.

I shall first describe the larger specimen.

The disk is high and very thick, and its outline is pentagonal; the upper face is strongly convex and it joins by a rounded edge the under face which is plane.

The upper face is occupied, centrally, by plates which are few, small, unequal, and irregularly polygonal; the space covered by them is of small extent. Distally, there come first the radial shields which are large, triangular, longer than wide, and the length of which very much exceeds half the radius of the disk. The two shields of each pair are separated over their whole length, but they are nearer one another distally than proximally and their internal edges are inclined toward each other; the external or interradial side is, on the contrary, almost exactly parallel to the corresponding side of the shield of the next pair. The two shields of each pair are separated by a row which includes three chief plates; the distal plate is very small and rectangular, the following one, which is larger, is triangular with rounded angles; lastly, the proximal plate, which is very large, generally offers also a triangular shape. This last plate, which proximally exceeds the end of the radial shields, is much protruding and carries a large conical tubercle with a blunt point, nearer to the distal angle of the plate; in one of the radii, this plate becomes double. A like, but smaller tubercle, appears also on the middle of the second plate. Two or three other very small plates fill up the interval between the last two plates. The interradial spaces are occupied by a row of narrow plates which generally amount to three; the first one is longer than wide, and the third one which is widened, occupies the margin of the disk. All the plates of the upper face of the disk appear to be firmly jointed to one another and their surface is covered with minute granules.

The upper face of the disk is beset by a small number of unequal and polygonal plates, among which are seen the elongated and narrow genital plates. The genital slits extend out on a small part of the length of these plates; they are very short and retain the same width over their whole length, without showing inwardly that widening which exists in *S. murrhina*.

The mouth shields are always divided into two unequal parts by a transverse fissure. The external region, which is by far the more important, is sensibly wider than long; it is semicircular, with an almost straight proximal side and a very convex distal side. The proximal region forms a small triangle which wedges between the two adoral plates on half their length; it is, in fact, the proximal angle of the mouth shield which has got separated from the rest of the plate. The adoral plates are fairly large, oval, or piriform. The oral plates are elongated and high, almost twice longer than wide. The oral papillæ amount to four on each side, and their size rapidly decreases from the external papilla, which is large and wide, to the last two which are small, low, and little distinct. The tooth papilla, which is odd, is conical and a little larger than the foregoing one.

The rather small upper brachial plates are swollen but not protruding; the first three are transversely widened and their length increases from the first one, which is very little developed, to the third; the latter is the largest of all; these three plates are contiguous on a large portion of their adjacent sides. Beyond the third one, the plates become triangular and about as long as wide, with a sharp proximal angle and a very convex distal side; the fourth plate is still contiguous with the third at its proximal angle, but, beyond the fourth, the plates are separated by an interval which is at first rather short and then becomes a little more elongated.

The first under brachial plate is pentagonal and a little longer than wide with an obtuse proximal angle, diverging lateral sides, and a convex distal side. The succeeding plates are very large, quadrangular, with a straight proximal side much narrower than the distal side which is widened; the latter is at first convex and then it is slightly notched in its middle; the sides are divergent. These plates are wider than long and they are all contiguous.

The largest portion of each lateral brachial plate is especially developed on the upper face of the arms; these plates wedge between the successive dorsal plates; their sides are parallel. The accessory piece is quadrangular, twice wider than long, with rounded angles.

The brachial spines, amounting to two only, are short and papilliform, lying on the plate and a little longer than wide, with a rounded end; the ventral spine is a little more widened than the other.

The tentacular scale is fairly developed and well apparent; it is rounded and flattened.

The brachial plates are, as the other plates of the body, covered with minute granules; these granules are a little more conspicuous on the lateral plates.

The color of the two examples in alcohol is grayish.

The smaller specimen corresponds fairly well to Verrill's description; it differs from it chiefly by the large radial plates, which separate the proximal regions from the radial shields. These plates already show a beginning of a protuberance corresponding to the conical and protruding tubercle which I have referred to above, and which does not yet exist on Verrill's specimen. The two radial shields of each pair are also slightly converging distally; the centro-dorsal plate is very distinct. The mouth shields have actually the same shape as in the adult, and their proximal angle is separated from the rest of the plate (an arrangement which Verrill does not mention, but which, however, seems to be indicated on his drawing).

The genital slits are already apparent. The under brachial plates are separated by the lateral plates.

Connections and differences.—*S. murrhina* was described by Lyman from a specimen, the diameter of which was 12 mm.; I do not think it possible to refer to that species the two specimens dredged by the *Albatross*, nor the young specimen from the Bahama expedition, as Verrill has done, for the arrangement of the plates of the upper face of the disk is very different. In fact, *S. murrhina* shows a distinct central rosette, and all the upper plates of the disk are coarsely tuberculous, but it does not offer the slightest indication of that large radial plate which is provided with a conical protuberance, nor of the similar plate which succeeds the former, both of which plates are characteristic of *S. conifera*. In the latter, the central rosette is already dissociated in a specimen which has a disk not exceeding 5.5 mm. in diameter. In *S. murrhina*, the disk itself is flattened and not thick and swollen; the upper brachial plates are transversely oval and not triangular; the shape of the mouth pieces and of the genital slits also differs in the two species. The arms also seem to be longer in *S. murrhina*, but this might be due to a difference in size.

In *S. lineata* Lütken and Mortensen from the Pacific, the upper plates of the disk are neither tuberculous nor protruding, and the brachial spines are three in number.

SIGSBEIA SEXRADIATA, new species.

Plate 17, figs. 4-5.

Albatross station 2753. Dec. 4, 1887. Lat. 13° 34' N.; long. 61° 03' W.; 281 fathoms; bk. s.; temp. 48° F. Two specimens fixed on a branch of coral.

Type.—Cat. No. 32308, U.S.N.M.

Both examples are very small and the diameters of the disk do not exceed, respectively, 2 and 1.5 mm.; however, they display characters sufficiently plain to allow of their being described and they are at once noticeable by the number of their arms, which are six. In the larger specimen four arms only are preserved, the other two being broken at their base; of the preserved arms, two are wider and a little longer than the others; all these arms are strongly rolled up and it is difficult to estimate their length which certainly does not reach 7 or 8 mm. In the smaller one, three arms only are preserved, one of which is smaller than the others.

The disk is circular, rather thick, with a rounded outline; it is depressed in its central region which is beset by a dozen small, polygonal, unequal, and irregularly arranged plates; there is not the slightest indication of a primary rosette. Outwardly come the radial shields, which form an uninterrupted circle; these shields are large, triangular, one and a half times longer than wide, with a rounded proximal angle and a concave distal side; the two shields of each pair are contiguous on the whole length of their radial side, and each pair is contiguous with two neighboring pairs. Each radial shield is succeeded by a large, rounded, and globulous plate, which is wider than long and sometimes divided into two successive parts; the two plates of each pair are generally separated by a narrow interval which allows the first upper brachial plate to be seen, while, on their external side, the plates are more approximated to the next ones or even are contiguous with them. These plates form the lateral faces of the disk and they extend over to the under face where

they meet the mouth shields. There are no other plates in the interradial spaces, and this is probably due to the youth of the samples. The genital slits appear as small, oval, and narrow openings, located between the external angle of each mouth shield and the first lateral brachial plate.

The mouth shields are small and very narrow; they are twice longer than wide, with a very obtuse proximal angle and two converging lateral sides which meet by a rounded angle; they are compressed between the two large plates which I have just mentioned and the adoral plates. The latter are very much developed; they are trapezoidal, the proximal side being twice as long as the distal side, and they are contiguous over the whole length of their internal side. The oral plates are small, longer than wide. The oral papillæ amount to four on each side; the external papilla is extremely large and wide, oval, squamiform, and obliquely erect; the following three are very small, papilliform and conical. The odd terminal papilla is scarcely larger than its neighbors.

The upper brachial plates are very large, excepting the first one, which is short; they are triangular, much wider than long, with an obtuse and rounded proximal angle and a more or less convex distal side, which meets the lateral sides by rounded angles. These plates are very much approximated to one another, but not absolutely in contact.

The under brachial plates are little developed, and the first three alone exist. The first plate is narrow and compressed between the two adoral plates; it is lozenge-shaped and longer than wide. The second and third plates are rather small, pentagonal, a little wider than long, their angles being rounded and not very distinct; they appear less plainly on the smaller than on the larger sample. Beyond these plates, the under face of the arms offers a narrow median stripe of membranous tissue, which is limited on both sides by the side plates.

The latter are developed chiefly on the arm sides and they do not meet on the median ventral line, but they always remain separated by that stripe of soft tissue which I have just referred to. They carry on their distal side a row of large, rounded, and rough globules, which are hardly longer than wide and amount to four at the base of the arms; these globules represent as many brachial spines and the last globule is somewhat smaller than the others. Within the row formed by the said spines there is a tentacular scale, the shape of which rather recalls that of the brachial spines, although it is more flattened and somewhat shorter than they are. The lateral plates are simple and there is no indication of a supplementary plate. All the plates of the body, as well on the disk as on the arms, are covered with very minute granules.

Connections and differences.—I refer to the genus *Sigsbeia* the two Ophiurans which I have just described, although their lateral plates are not divided, but this division might appear on older samples; the absence of under brachial plates on the largest part of the arms is evidently a youthful character. By the shape of the upper brachial plates, *S. sexradiata* recalls *S. conifera*, which I have just described, but it differs from it in the shape of the plates of the upper face of the disk as well as in the number of arms; this latter character, besides, separates *S. sexradiata* from the few other species actually known of the genus *Sigsbeia*.

Family ASTROCHEMIDÆ.

ASTROCHEMA ELONGATUM, new species.

Plate 17, figs. 1-3; plate 18, fig. 8.

Fish Hawk station 7280. Feb. 14, 1902. Lat. $24^{\circ} 17' 05''$ N.; long. $81^{\circ} 58' 25''$ W.; 132 fathoms; sand; temp. 52° F. Three specimens.

Type.—Cat. No. 32309, U.S.N.M.

The jar containing the three specimens was, unfortunately, badly corked and consequently reached me completely dried, as well as a few *Ophiomitra valida*, which accompanied them; the result is that the arms, which by the way are very long, are fixed up in the position which they occupied when in alcohol, and as they are strongly twisted up, it is rather difficult to form an accurate idea of their real length.

In the largest specimen, the diameter of the disk reaches 11 mm. from the end of a radial rib to the middle of the opposite interradius; the length of the arms must have been about 30 centimeters. The other two samples are smaller, and the diameters of their disks, respectively, measure 8 and 7 mm.

The disk is strongly excavated in the interradial spaces and is very thick. The upper face is convex, more or less depressed in the central region; the under face is plane. The upper face has 10 protruding and much elongated radial ribs which all meet toward the center of the disk; the two ribs of each pair always remain somewhat separated from each other by a more or less broad space. These ribs are very narrow and they preserve the same width over almost all their length, except at the proximal end which grows rapidly thinner and at the distal end which, on the contrary, is widened. These ribs are noticeable not only from their being very protruding, but also from their white color which shows off on the rest of the disk, the tegument of which is dark brown. They are beset with thick granules which are very dense and contiguous, and among which some bigger ones are noticeable which are separated by other much smaller ones; all these granules, even the largest ones, are rounded. The radial and interradial spaces of the upper face are covered by a tegument carrying granules which always remain smaller than those of the radial ribs; these granules also are unequal, but they are less dense than on the ribs. When reaching the margin of the disk, and also in the vicinity of the distal end of the radial ribs, these granules become a little coarser and they progressively extend over to the granules of the upper face of the arms.

The lateral faces of the disk, which are obliquely directed inwardly, meet the upper face by a rather conspicuous angle; they show the same coloring as the radial and interradial spaces of the said face, and they are covered with similar granules. The two genital slits of each interradial space are obliquely directed inward, and converge toward the ventral face; they are elongated, rather wide, and preserve the same width over their whole length, which reaches 3 mm.

The under face of the disk is covered with minute granules, of a uniform size, and separated from each other; these granules become a little stronger toward the margin of the disk in the interradial spaces; on the contrary, in the radial parts they succeed the analogous but somewhat smaller granules existing on the under face of the arms.

The outlines of the mouth pieces are completely hidden by the teguments. Large rounded granules, which form two or even three regular rows, extend along the mouth angles and represent oral papillæ. At the end of the jaws, there is a group of two or three tooth papillæ which are more developed than the preceding ones, flattened and lanceolate.

The arms are somewhat higher than broad; the upper face is strongly convex and the under face is flattened. They are a little narrower at the beginning and then they become slightly wider 2 or 3 centimeters from the base; at the same time, the division into successive rings becomes more apparent. The granules of the radial ribs extend over to the upper face of the arms where there are to be found, as well as on these ribs, fairly large granules separated by other smaller ones, it being so on the first six or eight brachial articles; beyond the granules lie wider apart, and at the same time, their size decreases and becomes uniform. There are then to be seen only loose minute granules which become still fewer and smaller as the distance from the disk increases; finally, the granules completely disappear about 10 centimeters from the basis of the arms, and their upper face consequently remains completely smooth.

The granules of the upper face of the arms extend over to the lateral faces with the same characters; they become, however, a little smaller and more uniform toward the under edge of the arms. On the under face of the arms granules are again found which are analogous to those of the upper face of the disk, although much smaller, but these granules rapidly become very small and fewer and they finally disappear 3 or 4 centimeters from the disk.

The first pair of brachial tentacular pores is deprived of scales. On each pore of the three succeeding pairs, one only is to be seen, and the second scale appears on the pores of the fifth pair in the largest specimen.

These scales always have the shape of almost cylindrical spines, with thin but obtuse ends. The length of the internal spine progressively increases from the pores of the second pair and it finally reaches one and a half articles; this spine is rather strong, a little thinned at its tip, and it shows in its terminal part, on about one-third of its length, rather strong successive denticulations. The external spine always remains much weaker; it is conical and more pointed than the internal one, and it hardly exceeds half the length of the latter; it also displays in its terminal part denticulations, which, however, are weaker than on the internal spine.

In the second specimen, the disk of which is 8 mm. in diameter, the external spine appears generally from the fourth article upward, and in the third specimen, which is smaller, it appears now on the fourth, now on the fifth article.

After the above description was written, I received an additional specimen from the U. S. National Museum, as follows:

Albatross station 2152. Apr. 30, 1884. $2\frac{1}{2}$ miles NW. of Havana Light; 387 fathoms; co., temp. 49° F. One specimen.

The specimen is incomplete; the arms are all broken off near the basis and a few loose fragments only are preserved.

The sample was labeled *Astrochema arenosum*, but the determination is evidently incorrect, and we have to deal here with *A. elongatum*, a new species which I have described above from specimens of the U. S. National Museum. I mention

this specimen here and reproduce (pl. 18, fig. 8) an arm piece, because it shows a peculiarity which I did not observe in the specimens which I used as types. In fact, at the level of each brachial article, one of the granules of the upper face is seen to take on a great development and to swell into a large conical nipple with rounded end, which is very conspicuous and very much protruding above the level of the next granules. This peculiarity is observed chiefly at the beginning of the arms. I can but mention this special arrangement, which might perhaps justify the introduction of a distinct variety, if it were found again on other samples. By all its other characters, this individual may be referred to *A. elongatum*.

Connections and differences.—Among the *Astrochema* for which *A. elongatum* might be mistaken, I shall cite chiefly *A. clavigerum* Verrill, *inornatum* K  hler, *intectum* Lyman, and *nuttingii* Verrill. The distinction between them will be found in the following characters.

A. clavigerum has protruding radial ribs, which, however, are widened; the upper face of the disk and arms is covered with small, smooth granules which become only a little stronger on the radial ribs without offering those inequalities which I notice in the new species. The internal tentacular scale takes on a remarkable development, and it is, besides, swollen at its end in the shape of a club. *A. inornatum* has wide and little protruding radial ribs, which are uniformly covered with small granules similar to those on the rest of the upper face of the disk; the upper face of the arms also is uniformly granulous and the granules are always less coarse than in *A. elongatum*. The arms are shorter and the internal brachial spine is more club-like toward the end; the second spine always appears a little farther away than in *A. elongatum*, and, as a rule, near the seventh pair of pores. In *A. intectum* from Havana, the under face of the arms is altogether bare and as to the tentacular scales there are already two appearing on the pores of the second pair. In *A. nuttingii*, the pores even of the first pair each carry a tentacular scale, and the second scale appears either on the pores of the second or on those of the third pair. The upper face of the arms offers but a bare tegument with a few very much reduced granules, which, however, become more distinct at a certain distance from the disk; the under face of the disk and of the arms is almost bare. The tentacular mouth pores each bear a little distal scale; the row of oral papill   is more regular and the tentacular scales are longer and narrower. Lastly, the radial ribs seem to be wider and less protruding than in *A. elongatum*.

The other species from the West Indies are easily distinguished from *A. elongatum*.

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EXPLANATION OF PLATES.

PLATE 1.

- Fig. 1. *Ophioderma elaps*, side view of an arm. $\times 3$.
 2. *Ophioderma elaps*, portion of the upper face of the disk and of an arm. $\times 3$.
 3. *Ophioglypha irrorata*, under face. $\times 2$.
 4. *Ophioglypha irrorata*, upper face. $\times 2$.
 5. *Ophioglypha sarsii*, young, upper face. $\times 9$.
 6. *Ophioglypha sarsii*, young, upper face. $\times 5$.
 7. *Ophiomusium rugosum*, upper face. $\times 4$.
 8. *Ophiomusium rugosum*, under face. $\times 4$.
 9. *Ophiomusium sculptum*, upper face. $\times 6$.

PLATE 2.

- Fig. 1. *Ophioderma* sp., young; upper face. $\times 4$.
 2. *Ophioderma* sp., young; under face. $\times 4$.
 3. *Ophioglypha coronata*, upper face. $\times 4$.
 4. *Ophioglypha coronata*, under face. $\times 4$.
 5. *Ophioglypha convexa*, under face. $\times 4$.
 6. *Ophioglypha convexa*, upper face. $\times 4$.

PLATE 3.

- Fig. 1. *Ophiomusium armigerum*, upper face. $\times 5$.
 2. *Ophioglypha lepida*, upper face. $\times 3$.
 3. *Ophiomusidium speciosum*, upper face. $\times 7$.
 4. *Ophiomusidium speciosum*, under face. $\times 7$.
 5. *Ophioglypha elevata*, under face. $\times 6$.
 6. *Ophiomyces mirabilis*, under face. $\times 6$.
 7. *Ophiomusium testudo*, upper face. $\times 7$.

PLATE 4.

- Fig. 1. *Amphiura flexuosa*, upper face. $\times 6$.
 2. *Amphiura flexuosa*, under face. $\times 6$.
 3. *Amphiura kinbergensis*, under face of a specimen from the *Albatross*. $\times 8$.
 4. *Amphiura kinbergensis*, under face of a specimen from the *Travailleur* and the *Talisman*. $\times 8$.
 5. *Amphiura latispina*, under face. $\times 7$.
 6. *Amphiura latispina*, upper face. $\times 7$.

PLATE 5.

- Fig. 1. *Amphiura kinbergensis*, upper face of a specimen from the *Albatross*. $\times 8$.
 2. *Amphiura kinbergensis*, upper face of a specimen from the *Travailleur* and the *Talisman*. $\times 8$.
 3. *Amphiura complanata*, upper face. $\times 4$.
 4. *Amphiura complanata*, under face of another specimen. $\times 5$.
 5. *Amphiura complanata*, upper face of the specimen illustrated in fig. 4. $\times 5$.
 6. *Amphiura complanata*, under face of the specimen illustrated in fig. 3. $\times 4$.
 7. *Ophiocnida loveni*, upper face. $\times 7$.
 8. *Ophiocnida loveni*, under face. $\times 7$.

PLATE 6.

- Fig. 1. *Amphiodia lütkeni*, upper face. $\times 7$.
2. *Amphiodia lütkeni*, under face. $\times 7$.
3. *Amphiodia riisei*, under face. $\times 7$.
4. *Amphiodia erecta*, upper face of smaller specimen. $\times 11$.
5. *Amphiodia erecta*, under face of the same. $\times 11$.
6. *Amphiodia erecta*, upper face of the larger specimen. $\times 6$.
7. *Amphiodia erecta*, under face of the same. $\times 6$.

PLATE 7.

- Fig. 1. *Amphiura stimpsoni*, upper face. $\times 11$.
2. *Amphiura stimpsoni*, under face. $\times 14$.
3. *Amphiura fibulata*, upper face. $\times 5$.
4. *Amphiura fibulata*, under face. $\times 7$.
5. *Amphiura fibulata*, upper face of the disk of the same specimen, more enlarged. $\times 7$.
6. *Amphiura diducta*, upper face. $\times 8$.
7. *Amphiura diducta*, under face. $\times 8$.

PLATE 8.

- Fig. 1. *Ophiophragmus wundermani*, upper face. $\times 4$.
2. *Ophiophragmus wundermani*, under face. $\times 4$.
3. *Ophiacantha bidentata*, under face. $\times 4$.
4. *Ophiacantha bidentata*, under face. $\times 4$.
5. *Amphiura otteri*, upper face of one of Ljungman's types. $\times 4$.
6. *Amphiura otteri*, under face of the same. $\times 4$.
7. *Amphiura otteri*, under face of a specimen from the *Albatross*. $\times 5$.
8. *Amphiura otteri*, under face of an arm of one of Ljungman's types. $\times 5$.
9. *Amphiura otteri*, upper face of the same arm. $\times 5$.

PLATE 9.

- Fig. 1. *Ophiacantha meridionalis*, upper face. $\times 6$.
2. *Ophiacantha meridionalis*, under face. $\times 6$.
3. *Ophiacantha pentacrinus*, upper face. $\times 10$.
4. *Ophiacantha pentacrinus*, under face. $\times 10$.
5. *Ophiacantha* sp., allied to *O. pentacrinus*, upper face. $\times 10$.
6. *Ophiacantha* sp., allied to *O. pentacrinus*, under face of the same specimen. $\times 10$.

PLATE 10.

- Fig. 1. *Ophiomitrella levis*, under face. $\times 10$.
2. *Ophiacantha granulifera*, upper face. $\times 4$.
3. *Ophiacantha granulifera*, under face. $\times 5$.
4. *Ophiomitra robusta*, upper face. $\times 4$.
5. *Ophiomitra robusta*, under face. $\times 4$.
6. *Ophiomitrella levis*, upper face. $\times 10$.

PLATE 11.

- Fig. 1. *Ophiacantha aculeata*, upper face. $\times 4$.
2. *Ophiacantha aculeata*, under face. $\times 4$.
3. *Ophiacantha (Ophiopristis) permixta*, upper face. $\times 4$.
4. *Ophiacantha (Ophiopristis) permixta*, under face. $\times 4.5$.
5. *Ophiacantha fraterna*, upper face. $\times 4$.
6. *Ophiacantha fraterna*, under face. $\times 4$.

PLATE 12.

- Fig. 1. *Ophiotrema gracilis*, upper face. $\times 4$.
 2. *Ophiotrema gracilis*, under face. $\times 5.5$.
 3. *Ophiotrema alberti*, upper face. $\times 3$.
 4. *Ophiotrema alberti*, under face. $\times 3$.
 5. *Ophiomitrella porrecta*, upper face. $\times 6$.
 6. *Ophiomitrella porrecta*, under face. $\times 6$.

PLATE 13.

- Fig. 1. *Ophiacantha (Ophiotrema) affinis*, under face. $\times 4$.
 2. *Ophiacantha (Ophiotrema) affinis*, upper face. $\times 4$.
 3. *Ophiacantha (Ophiotrema) affinis*, under face of another specimen. $\times 5$.
 4. *Ophiomitrella laevipellis*, upper face. $\times 9$.
 5. *Ophiomitrella laevipellis*, under face. $\times 9$.
 6. *Ophiacantha vepatica*, upper face. $\times 5$.

PLATE 14.

- Fig. 1. *Ophiochondrus granulatus*, under face. $\times 7$.
 2. *Ophiochondrus armatus*, upper face. $\times 8$.
 3. *Ophiochondrus armatus*, under face. $\times 8$.
 4. *Ophiochondrus granulatus*, upper face of a small specimen. $\times 6$.
 5. *Ophiochondrus granulatus*, upper face of a larger specimen, the under face of which is illustrated in fig. 1. $\times 6$.
 6. *Ophiochondrus armatus*, more enlarged under face of the specimen illustrated in fig. 3. $\times 7$.
 7. *Sigsbeia conifera*, upper face. $\times 8$.

PLATE 15.

- Fig. 1. *Ophiomitrella americana*, upper face. $\times 6$.
 2. *Ophiomitrella americana*, under face. $\times 6$.
 3. *Ophiacantha anomala*, upper face of a fairly large specimen. $\times 8$.
 4. *Ophiacantha anomala*, under face of the same. $\times 4$.
 5. *Ophiacantha anomala*, under face of a young specimen. $\times 8$.
 6. *Ophioloploplax atlantica*, upper face. $\times 7$.
 7. *Ophioloploplax atlantica*, under face. $\times 7$.

PLATE 16.

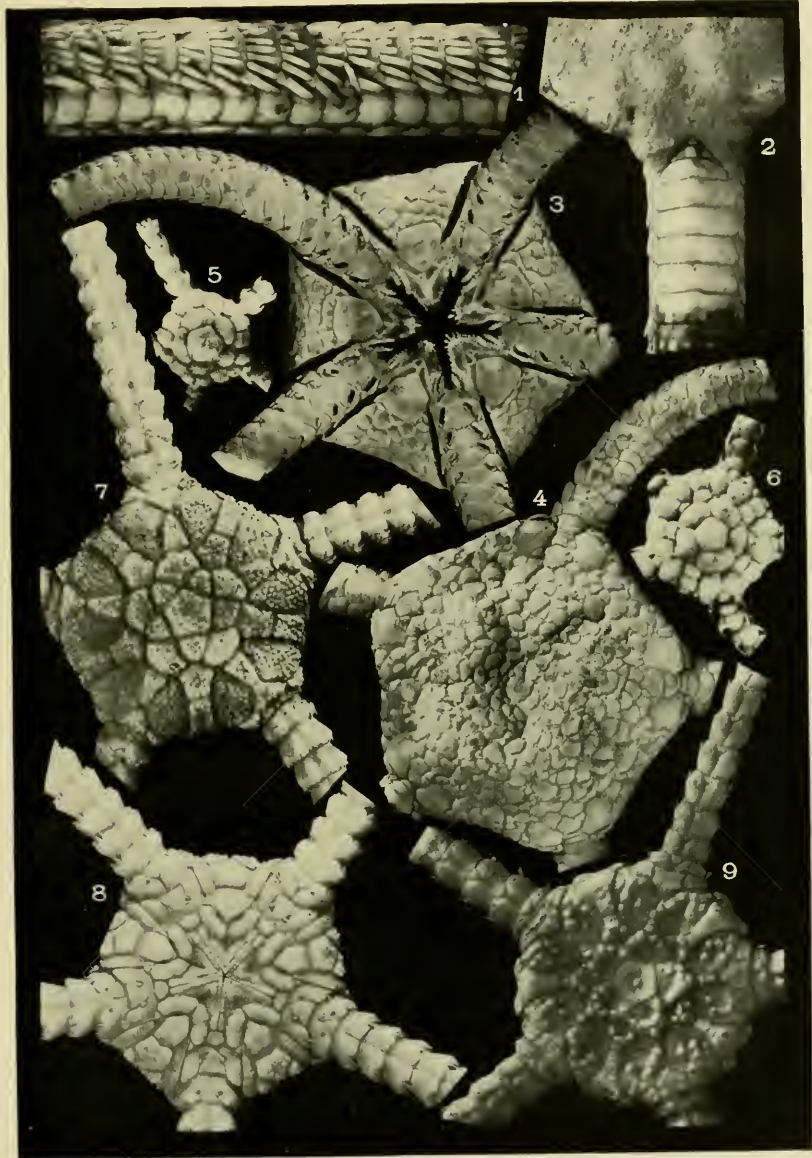
- Fig. 1. *Ophiotrix convoluta*, upper face. $\times 4$.
 2. *Ophiobyrsella quadrispinosa*, upper face. $\times 1.7$.
 3. *Ophiobyrsella quadrispinosa*, under face. $\times 1.7$.
 4. *Ophiologinus secundus*, upper face. $\times 10$.
 5. *Ophiologinus secundus*, under face. $\times 12$.
 6. *Ophiotrix convoluta*, upper face of the disk, more enlarged than in fig. 1. $\times 7.5$.

PLATE 17.

- Fig. 1. *Astrochema elongatum*, upper face. $\times 3$.
 2. *Astrochema elongatum*, under face of the whole animal, slightly reduced.
 3. *Astrochema elongatum*, under face, more enlarged. $\times 3$.
 4. *Sigsbeia scxradiata*, upper face. $\times 11$.
 5. *Sigsbeia scxradiata*, under face. $\times 11$.
 6. *Sigsbeia conifera*, under face. $\times 8$.

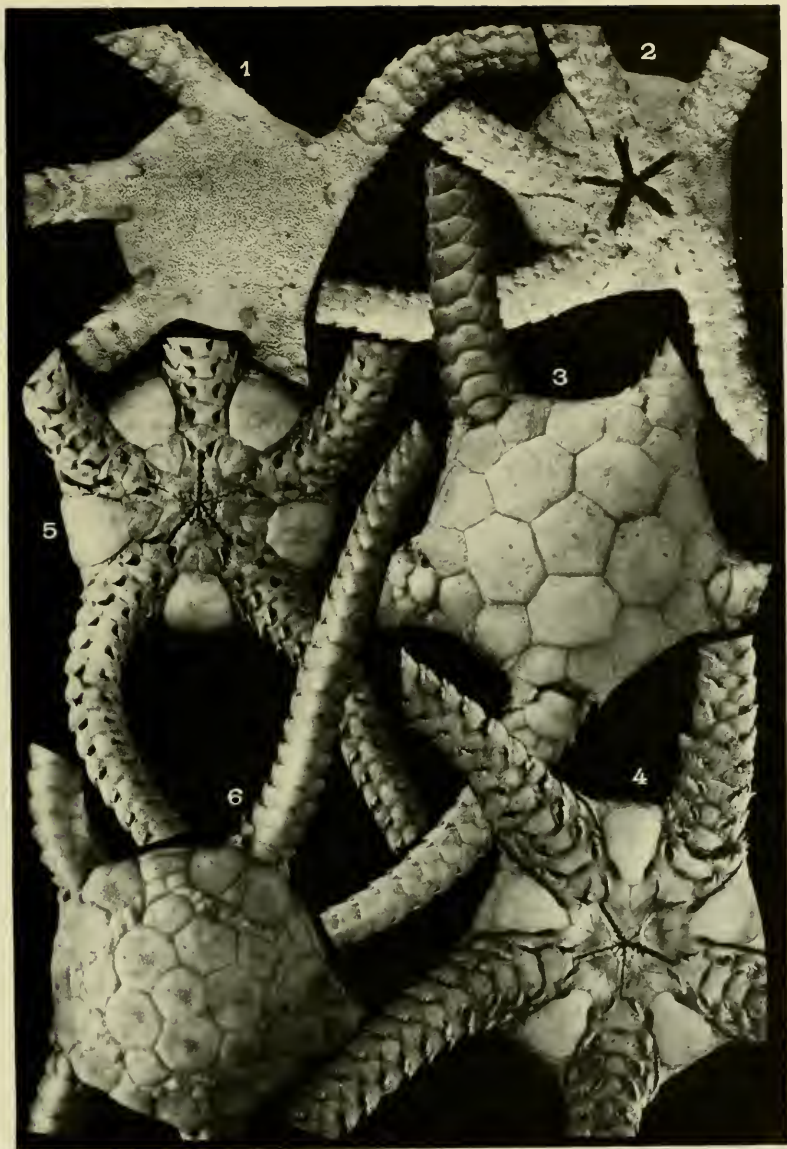
PLATE 18.

- Fig. 1. *Amphiura palmeri*, under face. $\times 7$.
2. *Ophioderma clypeata*, upper face. $\times 1.6$.
3. *Amphiura palmeri*, upper face. $\times 6$.
4. *Ophioderma elaps*, under face. $\times 2.7$.
5. *Amphiura rathbuni*, upper face. $\times 7$.
6. *Ophioderma clypeata*, under face. $\times 2.7$.
7. *Amphiura rathbuni*, under face. $\times 7$.
8. *Astrochema elongatum*, side view of an arm near the base. $\times 3$.



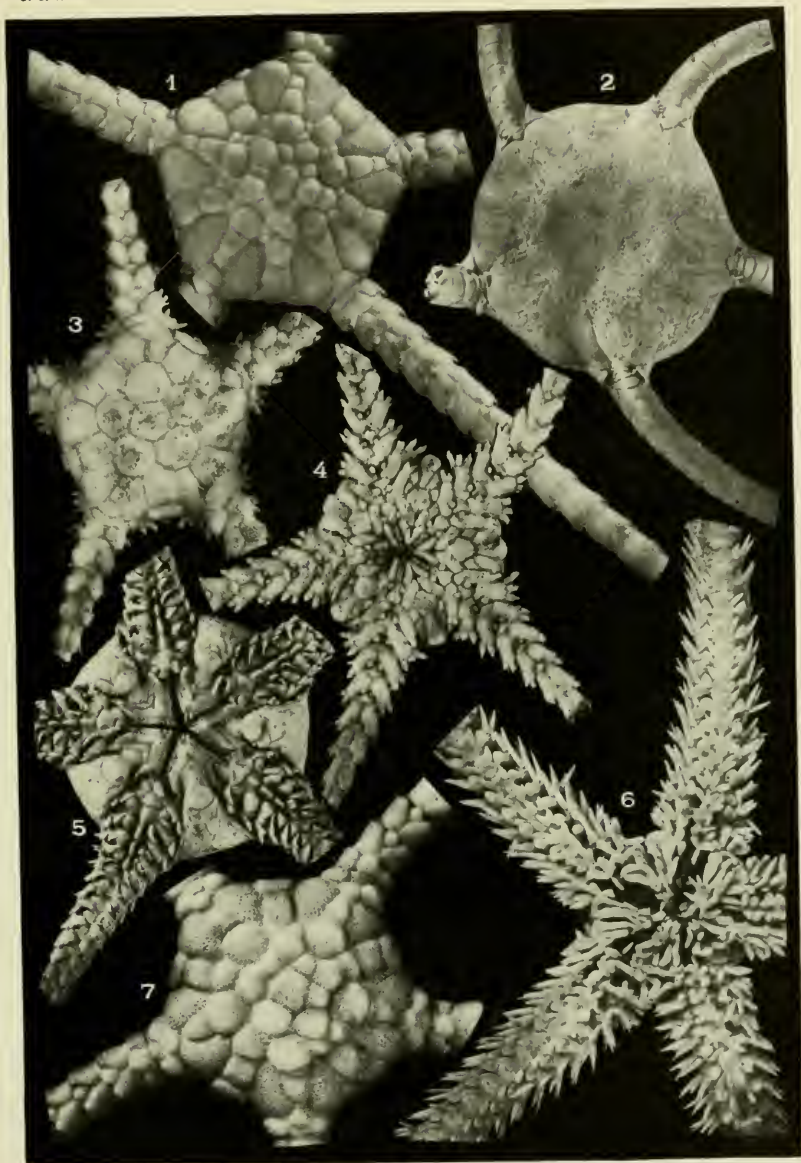
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FOR EXPLANATION OF PLATE SEE PAGE 143.



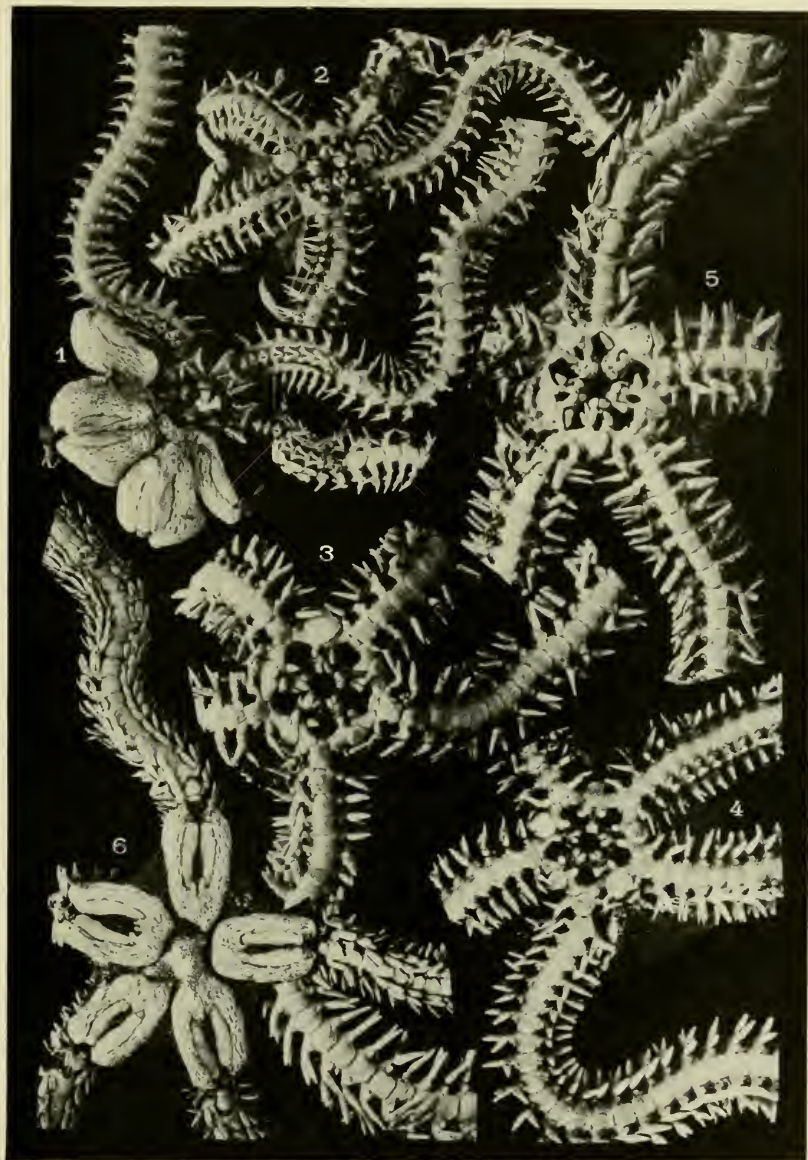
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FOR EXPLANATION OF PLATE SEE PAGE 143.



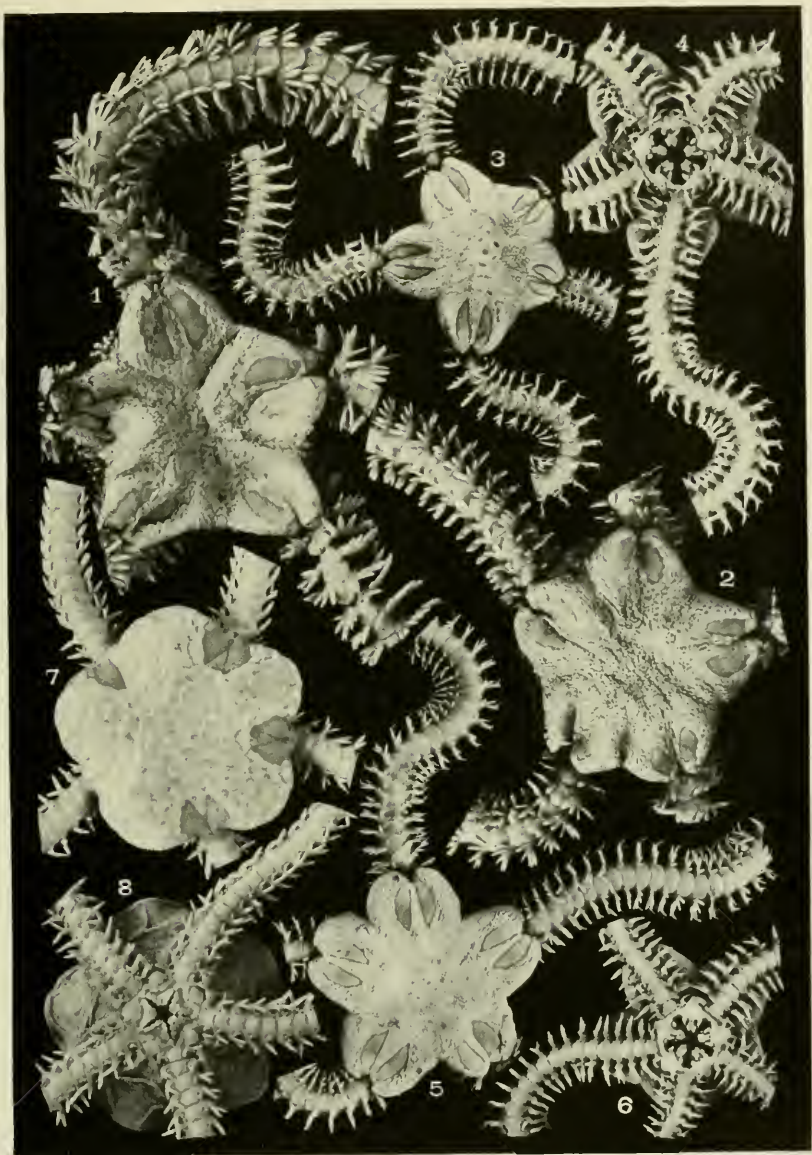
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FOR EXPLANATION OF PLATE SEE PAGE 143.



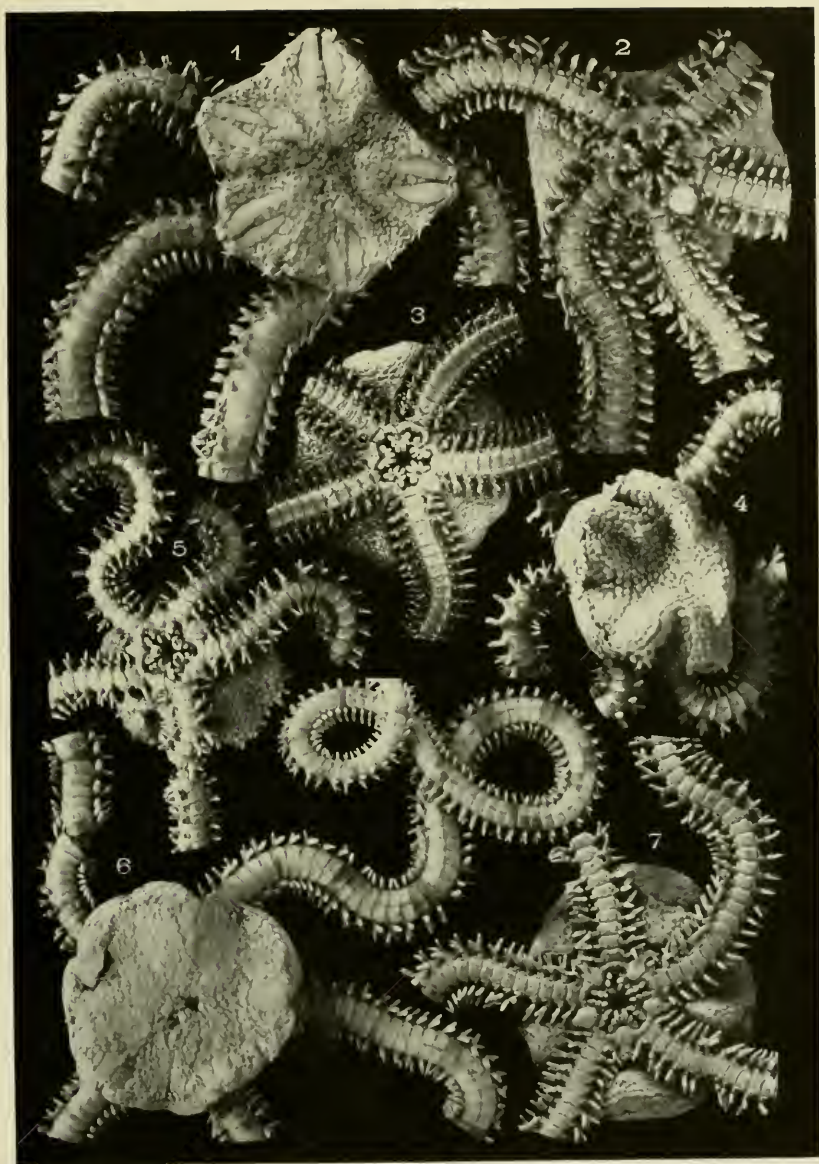
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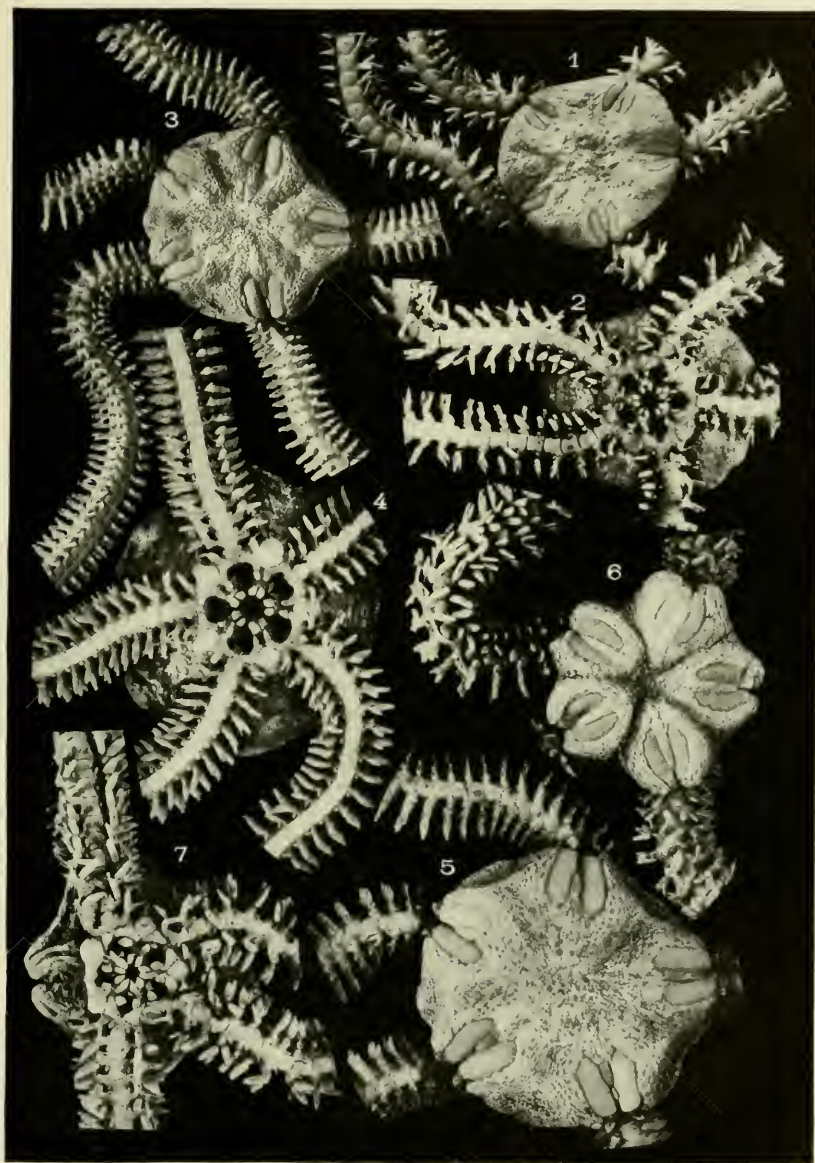
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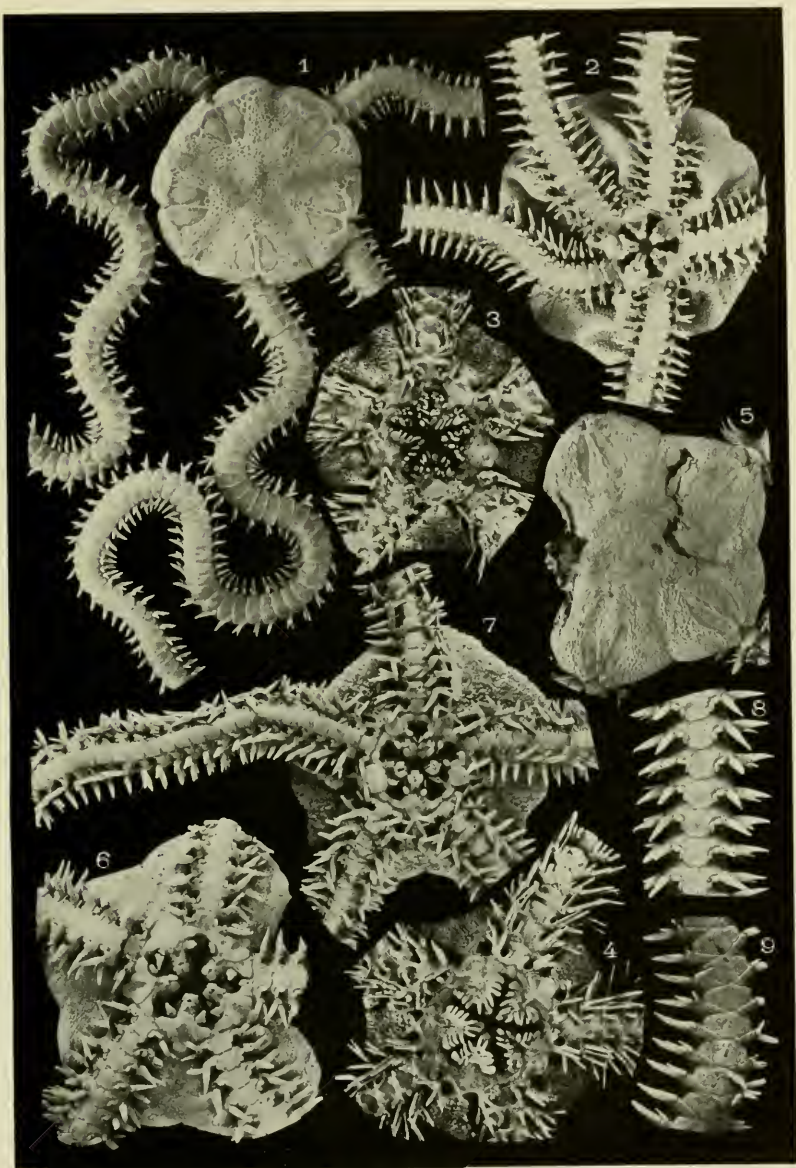
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FOR EXPLANATION OF PLATE SEE PAGE 144.



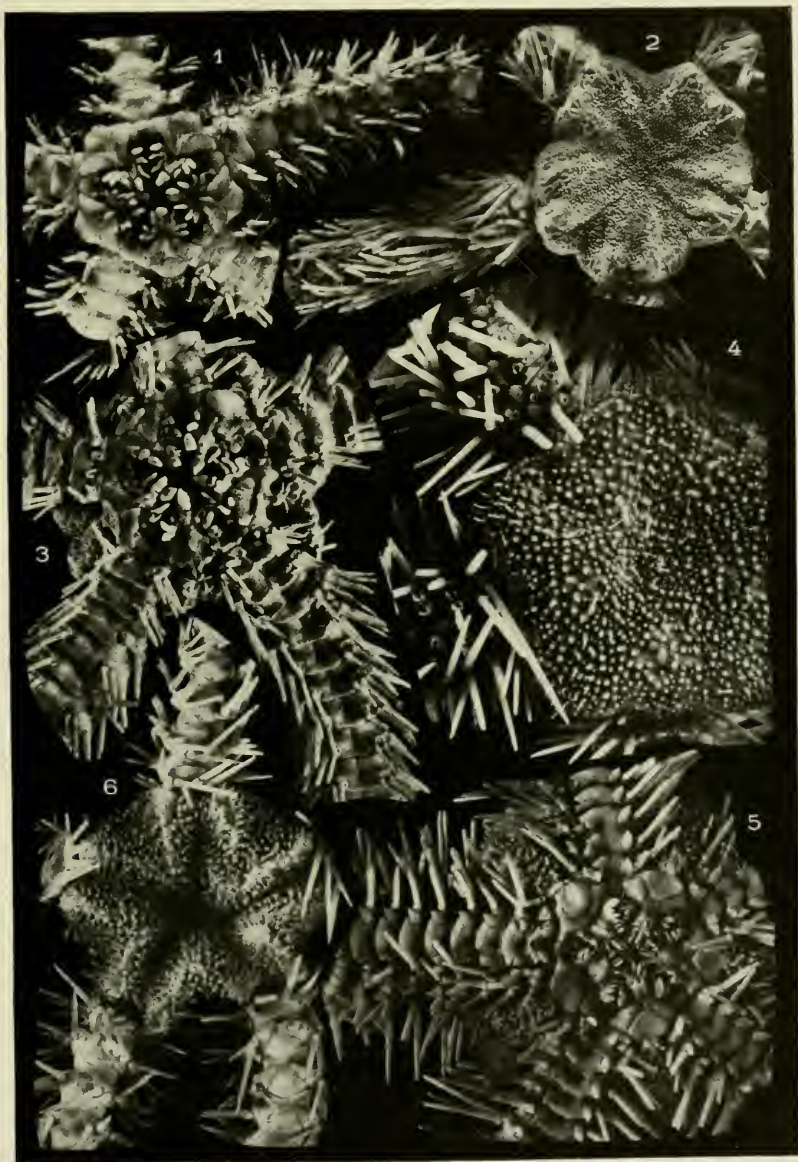
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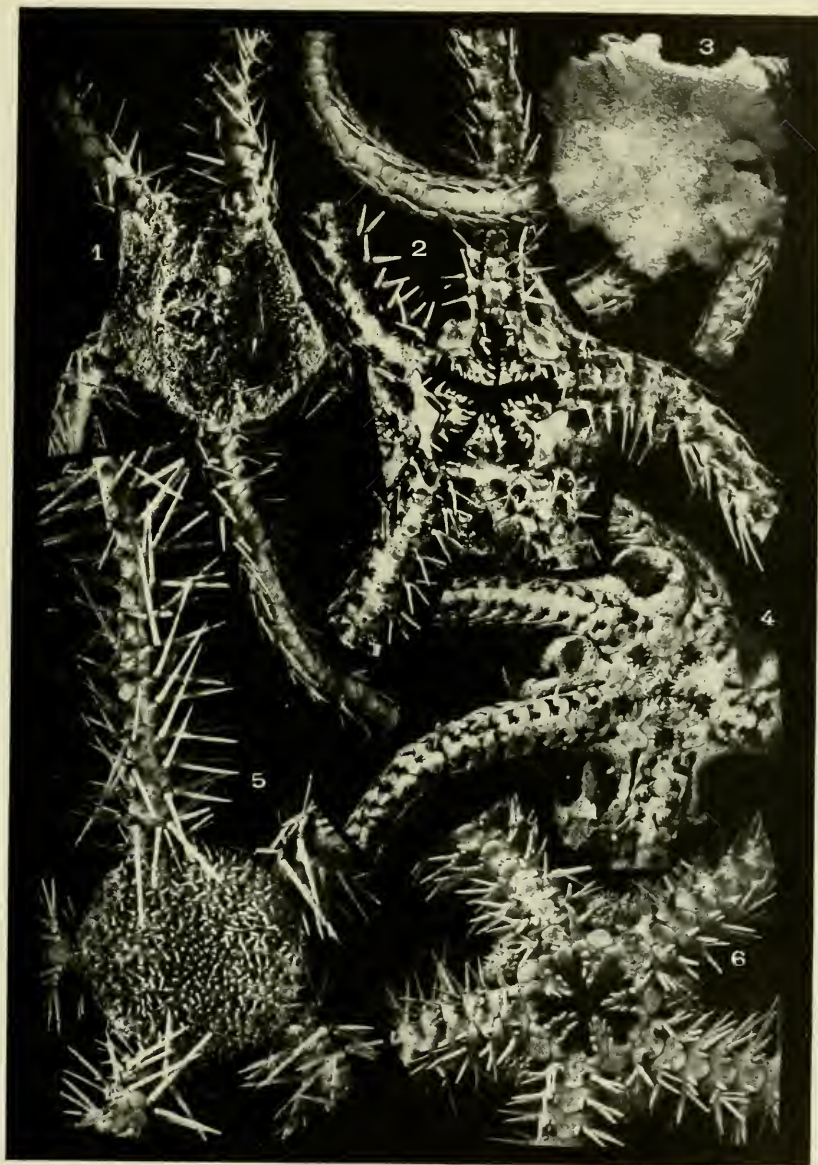
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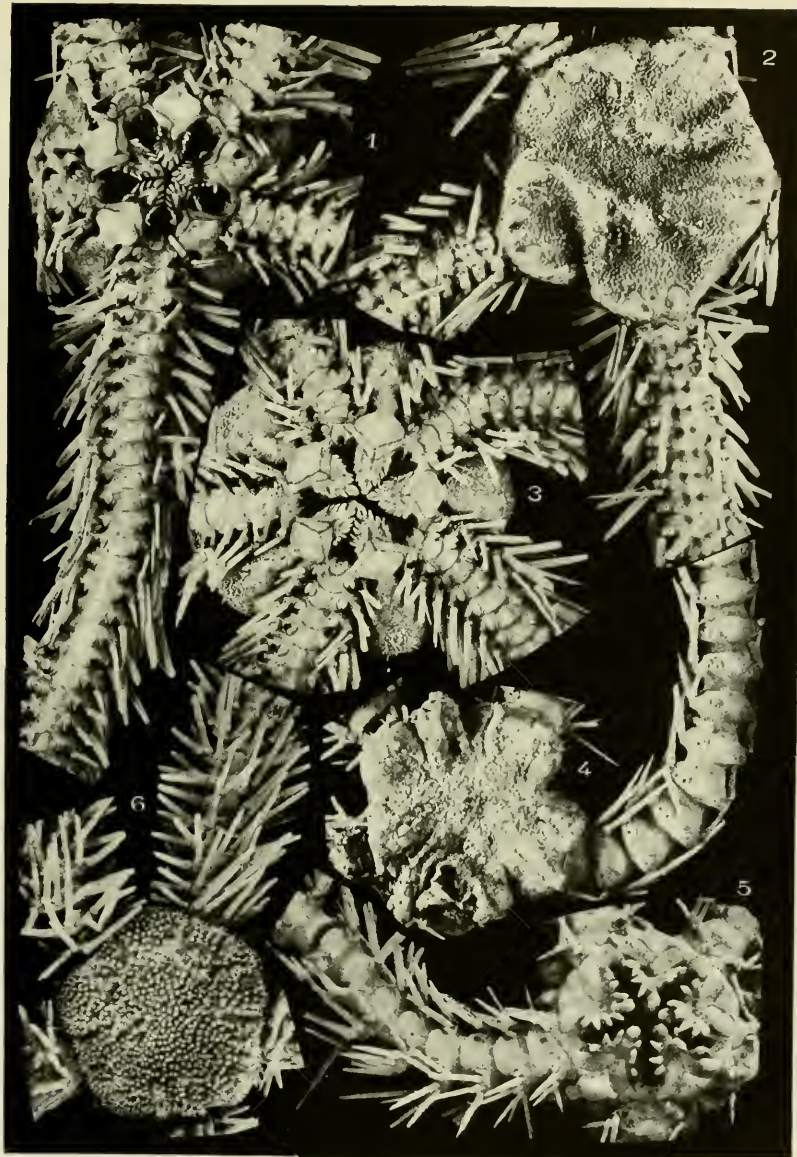
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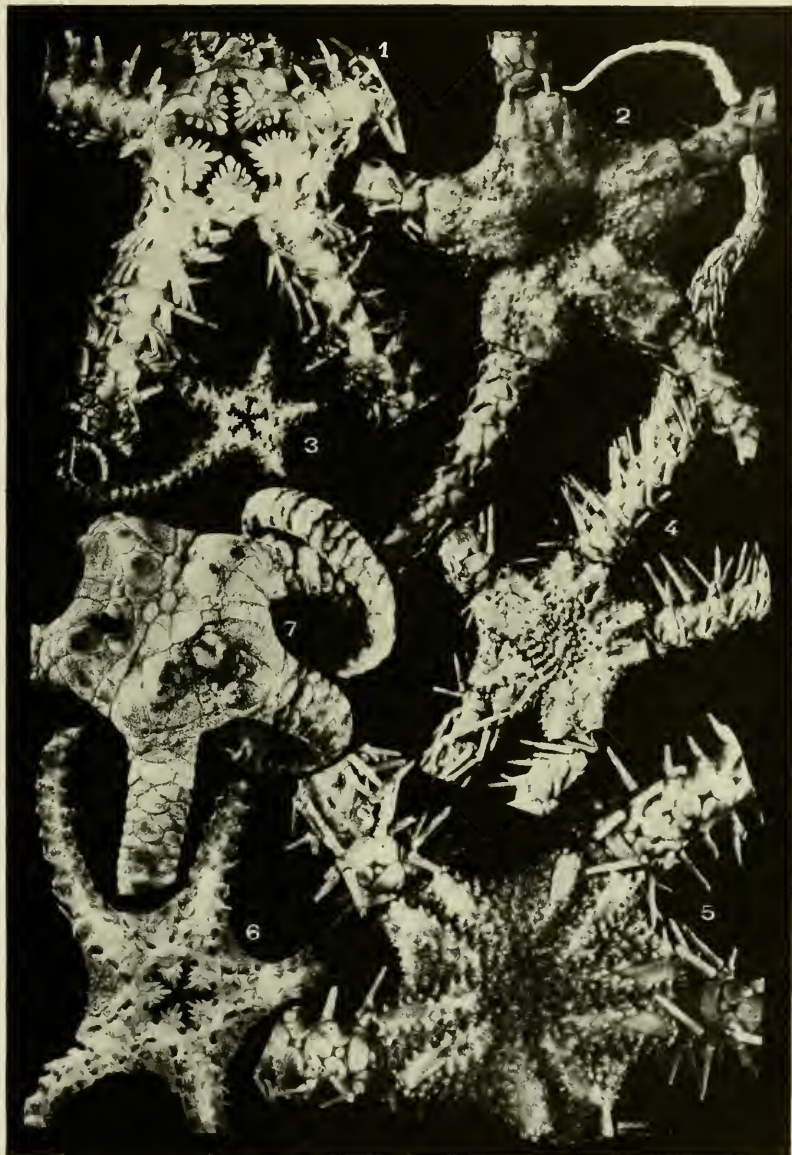
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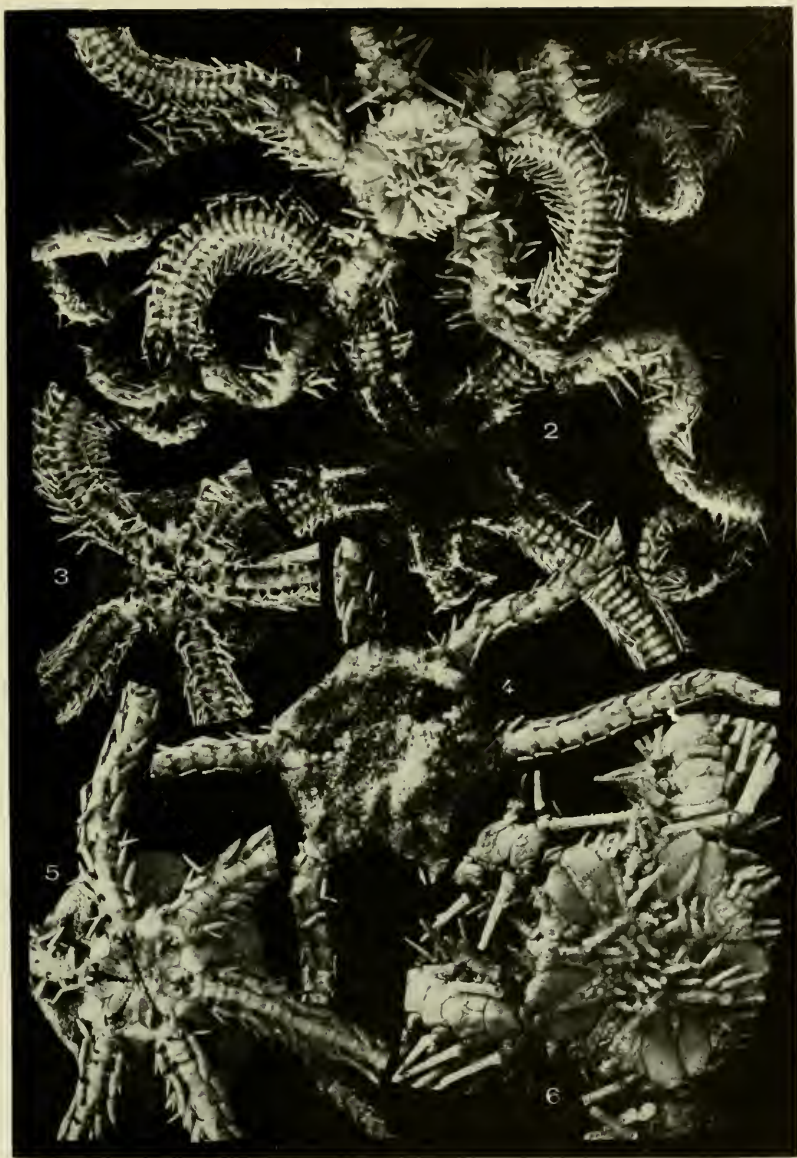
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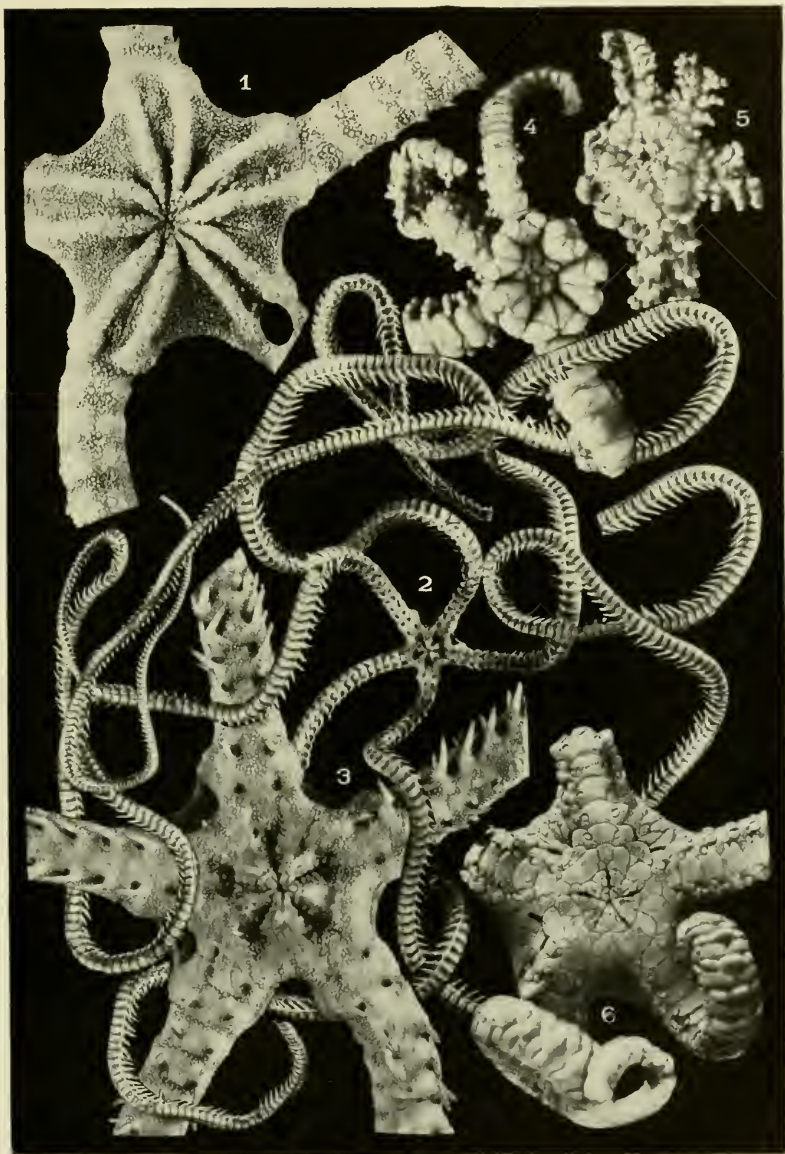
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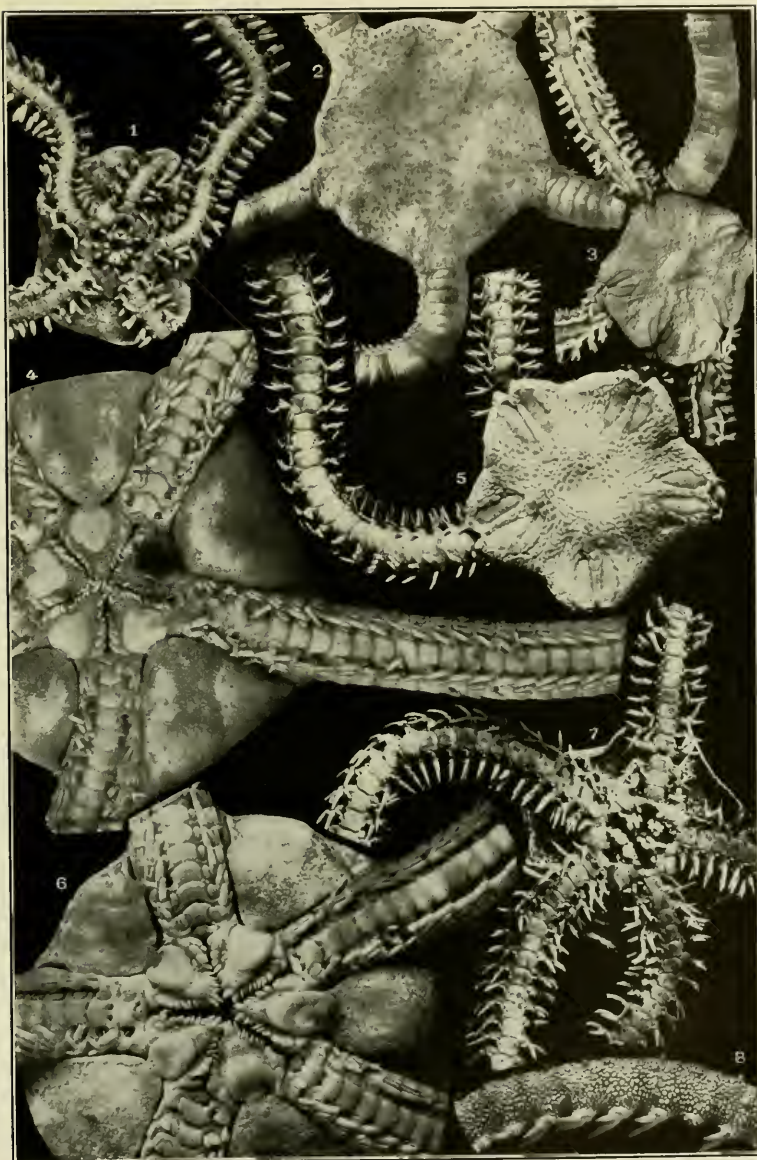
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OPHIURANS OF THE U. S. NATIONAL MUSEUM.

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A SUPPLEMENTARY LIST OF WEST INDIAN OPHIURANS IN THE UNITED STATES
NATIONAL MUSEUM IDENTIFIED BY THEODORE LYMAN.

These have not been examined by Prof. R. Kœhler and consequently are not mentioned in the preceding portion of this Bulletin.

OPHIURÆ.

Family OPHIODERMATIDÆ.

OPHIODERMA¹ APPRESSA (Say).

Nassau, Bahamas; J. I. and A. R. Northrop.
St. Thomas; A. H. Riise.
Old Providence; U. S. Fish Comm. Str. *Albatross*.
Caledonia Bay, Colombia.

OPHIODERMA BREVICAUDA Lütken.

St. Thomas; A. H. Riise.
St. Thomas; *Albatross*.
Caledonia Bay, Colombia.

OPHIODERMA BREVISPIÑA (Say).

Cape Florida, Florida; G. Wurdemann.
Marco, Florida; J. W. Velie.
Key West, Florida; *Albatross*.
Bahamas; H. Bryant.
St. Thomas; *Albatross*.
St. Thomas; A. H. Riise.
Sabanilla, Colombia.

Albatross station 2372, Feb. 7, 1885, lat. $29^{\circ} 15' 30''$ N.; long. $85^{\circ} 29' 30''$ W.,
27 fathoms, g.

Albatross station 2407, Mar. 15, 1885, lat. $28^{\circ} 47' 30''$ N.; long. $84^{\circ} 37' 00''$ W.,
24 fathoms, co. brk. sh.

OPHIODERMA CINEREA Müller and Troschel.

Key Biscayne, Florida; G. Wurdemann.
St. Thomas; A. H. Riise.
Belize, Honduras; W. A. Stanton.

Curaçao; *Albatross*; numerous specimens of which one is 4-armed.

Albatross station 2159, Apr. 30, 1884, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 08''$ W.,
98 fathoms, co.

Albatross station 2168, May 1, 1884, lat. $23^{\circ} 10' 36''$ N.; long. $82^{\circ} 20' 20''$ W.,
122 fathoms, co.

Albatross station 2320, Jan. 17, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 18' 48''$ W.,
130 fathoms, fine. co.

Albatross station 2322, Jan. 17, 1885, lat. $23^{\circ} 10' 54''$ N.; long. $82^{\circ} 17' 45''$ W.,
115 fathoms, co.

Albatross station 2334, Jan. 19, 1885, lat. $23^{\circ} 10' 42''$ N.; long. $82^{\circ} 18' 24''$ W.,
67 fathoms, wh. co.

¹ This was called *Ophiura* by Lyman.

OPHIODERMA RUBICUNDA Lütken.

St. Thomas; A. H. Riise.

OPHIOPALE GOËSIANA Ljungman.

Albatross station 2159, Apr. 30, 1884, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 08''$ W., 98 fathoms, co.*Albatross* station 2160, Apr. 30, 1884, lat. $23^{\circ} 10' 31''$ N.; long. $82^{\circ} 20' 37''$ W., 167 fathoms, co.*Albatross* station 2161, Apr. 30, 1884, lat. $23^{\circ} 10' 36''$ N.; long. $82^{\circ} 20' 28''$ W., 146 fathoms, co.*Albatross* station 2163, Apr. 30, 1884, lat. $23^{\circ} 10' 31''$ N.; long. $82^{\circ} 20' 29''$ W., 133 fathoms, co.*Albatross* station 2166, May 1, 1884, lat. $23^{\circ} 10' 36''$ N.; long. $82^{\circ} 20' 30''$ W., 196 fathoms, co., temp. 71.9° F.*Albatross* station 2319, Jan. 17, 1885, lat. $23^{\circ} 10' 37''$ N.; long. $82^{\circ} 20' 06''$ W., 143 fathoms, gy. co.*Albatross* station 2320, Jan. 17, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 18' 48''$ W., 130 fathoms, fne. co.*Albatross* station 2322, Jan. 17, 1885, lat. $23^{\circ} 10' 54''$ N.; long. $82^{\circ} 17' 45''$ W., 115 fathoms, co.*Albatross* station 2327, Jan. 17, 1885, lat. $23^{\circ} 11' 45''$ N.; long. $82^{\circ} 17' 54''$ W., 182 fathoms, fne. br. s.*Albatross* station 2329, Jan. 17, 1885, lat. $23^{\circ} 11' 03''$ N.; long. $82^{\circ} 18' 45''$ W., 118 fathoms, wh. co.*Albatross* station 2336, Jan. 19, 1885, lat. $23^{\circ} 10' 48''$ N.; long. $82^{\circ} 18' 52''$ W., 157 fathoms, co.*Albatross* station 2337, Jan. 19, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W., 199 fathoms, co.*Albatross* station 2346, Jan. 20, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W., 200 fathoms, co.*Albatross* station 2348, Jan. 20, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W., 211 fathoms, co.

OPHIOPYREN LONGISPINUS Lyman.

Albatross station 2354, Jan. 22, 1885, lat. $20^{\circ} 59' 30''$ N.; long. $86^{\circ} 23' 45''$ W., 130 fathoms, co.*Albatross* station 2355, Jan. 22, 1885, lat. $20^{\circ} 56' 48''$ N.; long. $86^{\circ} 27' 00''$ W., 399 fathoms, yl. oz.

OPHIARACHNELLA ANGULATA (Lyman).

Albatross station 2133-2134, Feb. 27, 1884, lat. $19^{\circ} 55' 55''$ to $56' 06''$ N.; long. $75^{\circ} 48' 03''$ to $47' 32''$ W., 290 to 254 fathoms, wh. s. brk. sh.*Albatross* station 2135, Feb. 27, 1884, lat. $19^{\circ} 55' 58''$ N.; long. $75^{\circ} 47' 07''$ W., 250 fathoms, hrd. co.*Albatross* station 2321, Jan. 17, 1885, lat. $23^{\circ} 10' 54''$ N.; long. $82^{\circ} 18' 00''$ W., 230 fathoms, fne. gy. s.*Albatross* station 2345, Jan. 20, 1885, lat. $23^{\circ} 10' 40''$ N.; long. $82^{\circ} 20' 15''$ W., 184 fathoms, fne. gy. wh. co.

OPHIARACHNELLA PETERSI (Lyman).

Albatross station 2320, Jan. 17, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 18' 48''$ W., 130 fathoms, fnc. co.

BATHYPECTINURA LACERTOSA (Lyman).

Albatross station 2379, Mar. 2, 1885, lat. $28^{\circ} 00' 15''$ N.; long. $87^{\circ} 42' 00''$ W., 1,467 fathoms, yl. oz.

Albatross station 2380, Mar. 2, 1885, lat. $28^{\circ} 02' 30''$ N.; long. $87^{\circ} 43' 45''$ W., 1,430 fathoms, br. m.; temp. 40.1° F.

Albatross station 2381, Mar. 2, 1885, lat. $28^{\circ} 05' 00''$ N.; long. $87^{\circ} 56' 15''$ W., 1,330 fathoms, lt. br. m.

Albatross station 2395, Mar. 13, 1885, lat. $28^{\circ} 36' 15''$ N.; long. $86^{\circ} 50' 00''$ W., 347 fathoms, gy. m.; temp. 44.1° F.

Albatross station 2396, Mar. 13, 1885, lat. $28^{\circ} 34' 00''$ N.; long. $86^{\circ} 48' 00''$ W., 335 fathoms, gy. m.

Family OPHIOLEPIDÆ.

OPHIOLEPIS ELEGANS Lüthen.

St. Thomas; *Albatross*.

Albatross station 2317, Jan. 15, 1885, lat. $24^{\circ} 25' 45''$ N.; long. $81^{\circ} 46' 45''$ W., 45 fathoms, co.; temp. 75° F.

Albatross station 2318, Jan. 15, 1885, lat. $24^{\circ} 25' 45''$ N.; long. $81^{\circ} 46' 00''$ W., 45 fathoms, co.; temp. 75° F.

Albatross station 2374, Feb. 7, 1885, lat. $29^{\circ} 11' 30''$ N.; long. $85^{\circ} 29' 00''$ W., 26 fathoms, s. g. brk. sh.

Albatross station 2388, Mar. 4, 1885, lat. $29^{\circ} 24' 30''$ N.; long. $88^{\circ} 01' 00''$ W., 35 fathoms, yl. s. bk. sp.

Albatross station 2389, Mar. 4, 1885, lat. $29^{\circ} 28' 00''$ N.; long. $87^{\circ} 56' 00''$ W., 27 fathoms, gy. s. brk. sh.

Albatross station 2405, Mar. 15, 1885, lat. $28^{\circ} 45' 00''$ N.; long. $85^{\circ} 02' 00''$ W., 30 fathoms, gy. s. brk. co.

Albatross station 2407, Mar. 15, 1885, lat. $28^{\circ} 47' 30''$ N.; long. $84^{\circ} 37' 00''$ W., 24 fathoms, co. brk. sh.

Albatross station 2410, Mar. 18, 1885, lat. $26^{\circ} 47' 30''$ N.; long. $83^{\circ} 25' 15''$ W., 28 fathoms, fnc. wh. s. bk. sp. brk. sh.

OPHIOLEPIS PAUCISPINA (Say).

Key West, Florida; *Albatross*.

St. Thomas; A. H. Riise.

OPHIOZONA MARMOREA Lyman.

Albatross station 2347, Jan. 20, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W., 216 fathoms, co.

OPHIOZONA CLYPEATA Lyman.

Albatross station 2338, Jan. 19, 1885, lat. $23^{\circ} 10' 40''$ N.; long. $82^{\circ} 20' 15''$ W., 189 fathoms, co.

Albatross station 2345, Jan. 20, 1885, lat. $23^{\circ} 10' 40''$ N.; long. $82^{\circ} 20' 15''$ W., 184 fathoms, fnc. gy. wh. co.

OPHIOZONA NIVEA Lyman.

Albatross station 2117, Jan. 27, 1884, lat. $15^{\circ} 24' 40''$ N.; long. $63^{\circ} 31' 30''$ W., 683 fathoms, yl. m. fine. s.; temp. 39.75° F.

Albatross station 2152, Apr. 30, 1884, $2\frac{1}{2}$ miles NW. of Havana Light, 387 fathoms, co.; temp. 49° F.

Albatross station 2159, Apr. 30, 1884, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 08''$ W., 98 fathoms, co.

Albatross station 2162, Apr. 30, 1884, lat. $23^{\circ} 10' 30''$ N.; long. $82^{\circ} 20' 25''$ W., 122 fathoms, co.

Albatross station 2167, May 1, 1884, lat. $23^{\circ} 10' 40''$ N.; long. $82^{\circ} 20' 30''$ W., 201 fathoms, co.

Albatross station 2168, May 1, 1884, lat. $23^{\circ} 10' 36''$ N.; long. $82^{\circ} 20' 20''$ W., 122 fathoms, co.

Albatross station 2321, Jan. 17, 1885, lat. $23^{\circ} 10' 54''$ N.; long. $82^{\circ} 18' 00''$ W., 230 fathoms, fine. gy. s.

Albatross station 2327, Jan. 17, 1885, lat. $23^{\circ} 11' 45''$ N.; long. $82^{\circ} 17' 54''$ W., 182 fathoms, fine. br. s.

Albatross station 2358, Jan. 29, 1885, lat. $20^{\circ} 19' 00''$ N.; long. $87^{\circ} 03' 30''$ W., 222 fathoms, fine. wh. co.

Albatross station 2359, Jan. 29, 1885, lat. $20^{\circ} 19' 10''$ N.; long. $87^{\circ} 03' 30''$ W., 231 fathoms, wh. co.; temp. 50.8° F.

OPHIOZONA TESSELLATA Lyman.

Albatross station 2321, Jan. 17, 1885, lat. $23^{\circ} 10' 54''$ N.; long. $82^{\circ} 18' 00''$ W., 230 fathoms, fine. gy. s.

Albatross station 2327, Jan. 17, 1885, lat. $23^{\circ} 11' 45''$ N.; long. $82^{\circ} 17' 54''$ W., 182 fathoms, fine. br. s.

OPHIOZONA IMPRESSA (Lütken).

Key West, Florida; *Albatross*.

St. Thomas; A. H. Riise.

St. Thomas; *Albatross*.

Curaçao; *Albatross*.

Albatross station 2136, Feb. 29, 1884, lat. $17^{\circ} 43' 40''$ N.; long. $75^{\circ} 38' 25''$ W., 52 fathoms, co. brk. sh.

Albatross station 2138, Feb. 29, 1884, lat. $17^{\circ} 44' 05''$ N.; long. $75^{\circ} 39' 00''$ W., 23 fathoms, co. brk. sh.

Albatross station 2159, Apr. 30, 1884, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 08''$ W., 98 fathoms, co.

Albatross station 2166, May 1, 1884, lat. $23^{\circ} 10' 36''$ N.; long. $82^{\circ} 20' 30''$ W., 196 fathoms, co.; temp. 71.9° F.

Albatross station 2322, Jan. 17, 1885, lat. $23^{\circ} 10' 54''$ N.; long. $82^{\circ} 17' 45''$ W., 115 fathoms, co.

Albatross station 2326, Jan. 17, 1885, lat. $23^{\circ} 11' 45''$ N.; long. $82^{\circ} 18' 54''$ W., 194 fathoms, br. co., temp. 62° F.

Albatross station 2327, Jan. 17, 1885, lat. $23^{\circ} 11' 45''$ N.; long. $82^{\circ} 17' 54''$ W., 182 fathoms, fine. br. s.

Albatross station 2335, Jan. 19, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W., 204 fathoms.

Albatross station 2336, Jan. 19, 1885, lat. $23^{\circ} 10' 48''$ N.; long. $82^{\circ} 18' 52''$ W., 157 fathoms, co.

Albatross station 2341, Jan. 19, 1885, lat. $23^{\circ} 11' 00''$ N.; long. $82^{\circ} 19' 06''$ W., 143 fathoms, co.

Albatross station 2345, Jan. 20, 1885, lat. $23^{\circ} 10' 40''$ N.; long. $82^{\circ} 20' 15''$ W., 184 fathoms, fine. gy. wh. co.

Albatross station 2349, Jan. 20, 1885, lat. $23^{\circ} 10' 40''$ N.; long. $82^{\circ} 20' 15''$ W., 182 fathoms, co.

OPHIOZONA DUBIA Lyman.

Albatross station 2383, Mar. 3, 1885, lat. $28^{\circ} 32' 00''$ N.; long. $88^{\circ} 06' 00''$ W., 1,181 fathoms, br. gn. m., temp. 39.8° F.

OPHIERNUS ADSPERSUS Lyman.

Albatross station 2143, Mar. 23, 1884, lat. $9^{\circ} 30' 45''$ N.; long. $76^{\circ} 25' 30''$ W., 155 fathoms, gn. m.

Albatross station 2359, Jan. 29, 1885, lat. $20^{\circ} 19' 10''$ N.; long. $87^{\circ} 03' 30''$ W., 231 fathoms, wh. co.; temp. 50.8° F.

Albatross station 2376, Feb. 11, 1885, lat. $29^{\circ} 03' 15''$ N.; long. $88^{\circ} 16' 00''$ W., 324 fathoms, gy. m.; temp. 46.5° F.

Albatross station 2394, Mar. 13, 1885, lat. $28^{\circ} 38' 30''$ N.; long. $87^{\circ} 02' 00''$ W., 420 fathoms, gn. m.; temp. 41.8° F.

Albatross station 2395, Mar. 13, 1885, lat. $28^{\circ} 36' 15''$ N.; long. $86^{\circ} 50' 00''$ W., 347 fathoms, gy. m.; temp. 44.1° F.

OPHIERNUS FASCICULATUS.

Albatross station 2143, Mar. 23, 1884, lat. $9^{\circ} 30' 45''$ N.; long. $76^{\circ} 25' 30''$ W., 155 fathoms, gn. m.

OPHIOTHYREUS GOËSSII Ljungman.

Albatross station 2321, Jan. 17, 1885, lat. $23^{\circ} 10' 54''$ N.; long. $82^{\circ} 18' 00''$ W., 230 fathoms, fine. gy. s.

Albatross station 2327, Jan. 17, 1885, lat. $23^{\circ} 11' 45''$ N.; long. $82^{\circ} 17' 54''$ W., 182 fathoms, fine. br. s.

Albatross station 2337, Jan. 19, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W., 199 fathoms, co.

Albatross station 2341, Jan. 19, 1885, lat. $23^{\circ} 11' 00''$ N.; long. $82^{\circ} 19' 06''$ W., 143 fathoms, co.

Albatross station 2345, Jan. 20, 1885, lat. $23^{\circ} 10' 40''$ N.; long. $82^{\circ} 20' 15''$ W., 184 fathoms, fine. gy. wh. co.

Albatross station 2346, Jan. 20, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W., 200 fathoms, co.

Albatross station 2348, Jan. 20, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W., 211 fathoms, co.

OPHIOLIPUS AGASSIZII Lyman.

Albatross station 2400, Mar. 14, 1885, lat. $28^{\circ} 41' 00''$ N.; long. $86^{\circ} 07' 00''$ W., 169 fathoms, gy. m.

OPHIOMASTUS SECUNDUS Lyman.

Albatross station 2117, Jan. 27, 1884, lat. $15^{\circ} 24' 40''$ N.; long. $63^{\circ} 31' 30''$ W., 683 fathoms, yl. m. fine. s.; temp. 39.75° F.

OPHIOLYPHA ACERVATA Lyman.

Albatross station 2140, Mar. 11, 1884, lat. $17^{\circ} 36' 10''$ N.; long. $76^{\circ} 46' 05''$ W., 966 fathoms, s.; temp. 39.7° F.

Albatross station, 2317, Jan. 15, 1885, lat. $24^{\circ} 25' 45''$ N.; long. $81^{\circ} 46' 45''$ W., 45 fathoms, co.; temp. 75° F.

Albatross station 2329, Jan. 17, 1885, lat. $23^{\circ} 11' 03''$ N.; long. $82^{\circ} 18' 45''$ W., 118 fathoms, wh. co.

Albatross station 2351, Jan. 21, 1885, lat. $22^{\circ} 41' 00''$ N.; long. $84^{\circ} 16' 30''$ W., 426 fathoms.

Albatross station 2392, Mar. 13, 1885, lat. $28^{\circ} 47' 30''$ N.; long. $87^{\circ} 27' 00''$ W., 724 fathoms, br. gy. m.; temp. 40.7° F.

Albatross station 2399, Mar. 14, 1885, lat. $28^{\circ} 44' 00''$ N.; long. $86^{\circ} 18' 00''$ W., 196 fathoms, gy. m.; temp. 51.6° F.

Albatross station 2400, Mar. 14, 1885, lat. $28^{\circ} 41' 00''$ N.; long. $86^{\circ} 07' 00''$ W., 169 fathoms, gy. m.

Albatross station 2401, Mar. 14, 1885, lat. $28^{\circ} 38' 30''$ N.; long. $85^{\circ} 52' 30''$ W., 142 fathoms, gn. m. brk. sh.

OPHIOLYPHA FALCIFERA Lyman.

Albatross station 2359, Jan. 29, 1885, lat. $20^{\circ} 19' 10''$ N.; long. $87^{\circ} 03' 30''$ W., 231 fathoms, wh. co.; temp. 50.8° F.

Albatross station 2398, Mar. 14, 1885, lat. $28^{\circ} 45' 00''$ N.; long. $86^{\circ} 26' 00''$ W., 227 fathoms, gy. m.; temp. 48.6° F.

OPHIOLYPHA AEQUALIS Lyman.

Albatross station 2140, Mar. 11, 1884, lat. $17^{\circ} 36' 10''$ N.; long. $76^{\circ} 46' 05''$ W., 966 fathoms, s.; temp. 39.7° F.

OPHIOLYPHA SCULPTILIS Lyman.¹

Albatross station 2351, Jan. 21, 1885, lat. $22^{\circ} 41' 00''$ N.; long. $84^{\circ} 16' 30''$ W., 426 fathoms.

Albatross station 2393, Mar. 13, 1885, lat. $28^{\circ} 43' 00''$ N.; long. $87^{\circ} 14' 30''$ W., 525 fathoms, lt. gy. m.; temp. 41.1° F.

Albatross station 2394, Mar. 13, 1885, lat. $28^{\circ} 38' 30''$ N.; long. $87^{\circ} 02' 00''$ W., 420 fathoms, gn. m.; temp. 41.8° F.

OPHIOLYPHA TENERA Lyman.

Albatross station 2127, Feb. 25, 1884, lat. $19^{\circ} 45' 00''$ N.; long. $75^{\circ} 04' 00''$ W., 1,639 fathoms, gn. m.

OPHIOMUSIUM EBURNEUM Lyman.

Albatross station 2130, Feb. 27, 1884, lat. $19^{\circ} 56' 25''$ N.; long. $75^{\circ} 49' 49''$ W., 175 fathoms, gy. m. s. brk. sh.

Albatross station 2159, Apr. 30, 1884, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 08''$ W., 98 fathoms, co.

Albatross station 2314, Jan. 5, 1885, lat. $32^{\circ} 43' 00''$ N.; long. $77^{\circ} 51' 00''$ W., 159 fathoms, ers. s. bk. sp. brk. sh.; temp. 47.4° F.

Albatross station 2320, Jan. 17, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 18' 48''$ W., 130 fathoms, fine. co.

Albatross station 2398, Mar. 14, 1885, lat. $28^{\circ} 45' 00''$ N.; long. $86^{\circ} 26' 00''$ W., 227 fathoms, gy. m.; temp. 48.6° F.

¹ Labeled *Ophiolypa variabilis* Lyman.

OPHIOMUSIUM SERRATUM Lyman.

Albatross station 2324, Jan. 17, 1885, lat. $23^{\circ} 10' 25''$ N.; long. $82^{\circ} 20' 24''$ W., 33 fathoms, co.; temp. 79.1° F.

Albatross station 2343, Jan. 19, 1885, lat. $23^{\circ} 11' 35''$ N.; long. $82^{\circ} 19' 25''$ W., 279 fathoms, fne. co.

Albatross station 2347, Jan. 20, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W., 216 fathoms, co.

OPHIOMUSIUM PLANUM Lyman.

Albatross station 2127, Feb. 25, 1884, lat. $19^{\circ} 45' 00''$ N.; long. $75^{\circ} 04' 00''$ W., 1,639 fathoms, gn. m.

Albatross station 2341, Jan. 19, 1885, lat. $23^{\circ} 11' 00''$ N.; long. $82^{\circ} 19' 06''$ W., 143 fathoms, co.

Albatross station 2342, Jan. 19, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W., 201 fathoms, co.

OPHIOMUSIUM ACUFERUM Lyman.

Albatross station 2159, Apr. 30, 1884, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 08''$ W., 98 fathoms, co.

Albatross station 2321, Jan. 17, 1885, lat. $23^{\circ} 10' 54''$ N.; long. $82^{\circ} 18' 00''$ W., 230 fathoms, fne. gy. s.

Albatross station 2327, Jan. 17, 1885, lat. $23^{\circ} 11' 45''$ N.; long. $82^{\circ} 17' 54''$ W., 182 fathoms, fne. br. s.

Albatross station 2335, Jan. 19, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W., 204 fathoms.

OPHIOMUSIUM VALIDUM Ljungman.

Albatross station 2117, Jan. 27, 1884, lat. $15^{\circ} 24' 40''$ N.; long. $63^{\circ} 31' 30''$ W., 683 fathoms.

Albatross station 2118, Jan. 28, 1884, lat. $13^{\circ} 32' 40''$ N.; long. $62^{\circ} 54' 00''$ W., 690 fathoms.

Albatross station 2129, Feb. 27, 1884, lat. $19^{\circ} 56' 04''$ N.; long. $75^{\circ} 48' 55''$ W., 274 fathoms, bu. m. fne. s.

Albatross station 2133, Feb. 27, 1884, lat. $19^{\circ} 55' 55''$ N.; long. $75^{\circ} 48' 03''$ W., 290 fathoms, wh. s. brk. sh.

Albatross station 2140, Mar. 11, 1884, lat. $17^{\circ} 36' 10''$ N.; long. $76^{\circ} 46' 05''$ W., 966 fathoms, s.; temp. 39.7° F.

Albatross station 2143, Mar. 23, 1884, lat. $9^{\circ} 30' 45''$ N.; long. $76^{\circ} 25' 30''$ W., 155 fathoms, gn. m.

Albatross station 2321, Jan. 17, 1885, lat. $23^{\circ} 10' 54''$ N.; long. $82^{\circ} 18' 00''$ W., 230 fathoms, fne. gy. s.

Albatross station 2327, Jan. 17, 1885, lat. $23^{\circ} 11' 45''$ N.; long. $82^{\circ} 17' 54''$ W., 182 fathoms, fne. br. s.

Albatross station 2351, Jan. 21, 1885, lat. $22^{\circ} 41' 00''$ N.; long. $84^{\circ} 16' 30''$ W., 426 fathoms.

Albatross station 2384, Mar. 3, 1885, lat. $28^{\circ} 45' 00''$ N.; long. $88^{\circ} 15' 30''$ W., 940 fathoms, br. gy. m.; temp. 39.6° F.

OPHIOMUSIUM TESTUDO Lyman.

Albatross station 2135, Feb. 27, 1884, lat. $19^{\circ} 55' 58''$ N.; long. $75^{\circ} 47' 07''$ W., 250 fathoms, hrd. co.

Albatross station 2152, Apr. 30, 1884, $2\frac{1}{2}$ miles NW. of Havana Light, 387 fathoms, co.; temp. 49° F.

Albatross station 2159, Apr. 30, 1884, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 08''$ W., 98 fathoms, co.

Albatross station 2327, Jan. 17, 1885, lat. $23^{\circ} 11' 45''$ N.; long. $82^{\circ} 17' 54''$ W., 182 fathoms, fne. br. s.

Albatross station 2335, Jan. 19, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W., 204 fathoms.

Albatross station 2337, Jan. 19, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W., 199 fathoms, co.

Albatross station 2338, Jan. 19, 1885, lat. $23^{\circ} 10' 40''$ N.; long. $82^{\circ} 20' 15''$ W., 189 fathoms, co.

Albatross station 2341, Jan. 19, 1885, lat. $23^{\circ} 11' 00''$ N.; long. $82^{\circ} 19' 06''$ W., 143 fathoms, co.

Albatross station 2346, Jan. 20, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W., 200 fathoms, co.

Albatross station 2359, Jan. 29, 1885, lat. $20^{\circ} 19' 10''$ N.; long. $87^{\circ} 03' 30''$ W., 231 fathoms, wh. co.

Family AMPHIURIDÆ.

OPHIOSTIGMA ISACANTHUM (Say).

Key West, Florida; *Albatross*; one specimen with 6 arms.

St. Thomas; *Albatross*.

Curaçao; *Albatross*.

Albatross station 2362, Jan. 30, 1885, lat. $22^{\circ} 08' 30''$ N.; long. $86^{\circ} 53' 30''$ W., 25 fathoms, co. s.

Albatross station 2405, Mar. 15, 1885, lat. $28^{\circ} 45' 00''$ N.; long. $85^{\circ} 02' 00''$ W., 30 fathoms, gy. s. brk. co.

Albatross station 2406, Mar. 15, 1885, lat. $28^{\circ} 46' 00''$ N.; long. $84^{\circ} 49' 00''$ W., 26 fathoms, crs. s. co.

HEMIPHOLIS ELONGATA (Say).¹

South Carolina; J. D. Kurtz.

Trinidad; *Albatross*.

OPHIACTIS SAVIGNYI (Müller and Troschel).

Key West, Florida; *Albatross*.

St. Thomas; *Albatross*.

Curaçao; *Albatross*.

OPHIACTIS MÜLLERI Lütken.

St. Thomas; A. H. Riise.

Albatross station 2138, Feb. 29, 1884, lat. $17^{\circ} 44' 05''$ N.; long. $75^{\circ} 39' 00''$ W., 23 fathoms, co. brk. sh.

Albatross station 2405, Mar. 15, 1885, lat. $28^{\circ} 45' 00''$ N.; long. $85^{\circ} 02' 00''$ W., 30 fathoms, gy. s. brk. co.

¹ Labeled by Lyman, *Hemipholis cordifera* Lyman.

OPHIACTIS PLANA Lyman.

Albatross station 2389, Mar. 4, 1885, lat. $29^{\circ} 28' 00''$ N.; long. $87^{\circ} 56' 00''$ W., 27 fathoms, gy. s. brk. sh.

Albatross station 2390, Mar. 4, 1885, lat. $29^{\circ} 27' 30''$ N.; long. $87^{\circ} 48' 30''$ W., 30 fathoms, crs. s. bk. sp. sh.

Albatross station 2406, Mar. 15, 1885, lat. $28^{\circ} 46' 00''$ N.; long. $84^{\circ} 49' 00''$ W., 26 fathoms, crs. s. co.

OPHIACTIS KREBSII Lütken.

St. Thomas; A. H. Riise.

AMPHILIMNA OLIVACEA (Lyman).¹

Albatross station 2121-2122, Feb. 3, 1884, lat. $10^{\circ} 37' 00''$ N.; long. $61^{\circ} 44' 22''$ W., 34 fathoms, dk. slate col. m.; temp. 67° F. and 73° F.

Albatross station 2145, Apr. 2, 1884, lat. $9^{\circ} 27' 00''$ N.; long. $79^{\circ} 54' 00''$ W., 25 fathoms, gn. m. brk. sh.

Albatross station 2401, Mar. 14, 1885, lat. $28^{\circ} 38' 30''$ N.; long. $85^{\circ} 52' 30''$ W., 142 fathoms, gn. m. brk. sh.

OPHIONEREIS RETICULATA (Say).

Key West, Florida; *Albatross*.

St. Thomas; A. H. Riise.

Curaçao; *Albatross*.

Albatross station 2167, May 1, 1884, lat. $23^{\circ} 10' 40''$ N.; long. $82^{\circ} 20' 30''$ W., 201 fathoms, co.

Albatross station 2323, Jan. 17, 1885, lat. $23^{\circ} 10' 51''$ N.; long. $82^{\circ} 19' 03''$ W., 163 fathoms, wh. br. co.

Albatross station 2330, Jan. 17, 1885, lat. $23^{\circ} 10' 48''$ N.; long. $82^{\circ} 19' 15''$ W., 121 fathoms, fine. gy. co.

OPHIOLAX LJUNGMANI Lyman.

Albatross station 2319, Jan. 17, 1885, lat. $23^{\circ} 10' 37''$ N.; long. $82^{\circ} 20' 06''$ W., 143 fathoms, gy. co.

Albatross station 2320, Jan. 17, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 18' 48''$ W., 130 fathoms, fine. co.

Albatross station 2327, Jan. 17, 1885, lat. $23^{\circ} 11' 45''$ N.; long. $82^{\circ} 17' 54''$ W., 182 fathoms, fine. br. s.

Albatross station 2342, Jan. 19, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W., 201 fathoms, co.

OPHIOPSILA RIISEI Lütken.

Cape Florida, Florida; G. Wurdemann.

Albatross station 2136, Feb. 29, 1884, lat. $17^{\circ} 43' 40''$ N.; long. $75^{\circ} 38' 25''$ W., 52 fathoms, co. brk. sh.

Albatross station 2138, Feb. 29, 1884, lat. $17^{\circ} 44' 05''$ N.; long. $75^{\circ} 39' 00''$ W., 23 fathoms, co. brk. sh.

Albatross station 2146, Apr. 2, 1884, lat. $9^{\circ} 32' 00''$ N.; long. $79^{\circ} 54' 30''$ W., 34 fathoms, brk. sh.

Albatross station 2323, Jan. 17, 1885, lat. $23^{\circ} 10' 51''$ N.; long. $82^{\circ} 19' 03''$ W., 163 fathoms, wh. br. co.

¹ Labeled by Lyman, *Ophiocnida olivacea*.

AMPHIURA OTTERI Ljungman.

Albatross station 2329, Jan. 17, 1885, lat. $23^{\circ} 11' 03''$ N.; long. $82^{\circ} 18' 45''$ W., 118 fathoms, wh. co.

AMPHIURA GRANDISQUAMA Lyman.

Albatross station 2320, Jan. 17, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 18' 48''$ W., 130 fathoms, fine. co.

AMPHIURA SEMIERMIS Lyman.

Albatross station 2317, Jan. 15, 1885, lat. $24^{\circ} 25' 45''$ N.; long. $81^{\circ} 46' 45''$ W., 45 fathoms, co.

AMPHIURA LIMBATA (Grube.)

Sabanilla, Colombia; *Albatross*.

AMPHIURA RIISEI Lütken.

Albatross station 2142, Mar. 23, 1884, lat. $9^{\circ} 30' 15''$ N.; long. $76^{\circ} 20' 30''$ W., 42 fathoms, gn. m. s.

Albatross station 2145, Apr. 2, 1884, lat. $9^{\circ} 27' 00''$ N.; long. $79^{\circ} 54' 00''$ W., 25 fathoms, gn. m. brk. sh.

AMPHIURA INCISA Lyman.

Albatross station 2144, Mar. 25, 1884, lat. $9^{\circ} 49' 00''$ N.; long. $79^{\circ} 31' 30''$ W., 896 fathoms, gn. m.

Albatross station 2384, Mar. 3, 1885, lat. $28^{\circ} 45' 00''$ N.; long. $88^{\circ} 15' 30''$ W., 940 fathoms, br. gy. m.; temp. 39.6° F.

AMPHIURA REPENS Lyman.

Albatross station 2362, Jan. 30, 1885, lat. $22^{\circ} 08' 30''$ N.; long. $86^{\circ} 53' 30''$ W., 25 fathoms, co. s.

Albatross station 2372, Feb. 7, 1885, lat. $29^{\circ} 15' 30''$ N.; long. $85^{\circ} 29' 30''$ W., 27 fathoms, g.

Albatross station 2373, Feb. 7, 1885, lat. $29^{\circ} 14' 00''$ N.; long. $85^{\circ} 29' 15''$ W., 25 fathoms, co.

AMPHIURA DUPLICATA Lyman.

Albatross station 2117, Jan. 27, 1884, lat. $15^{\circ} 24' 40''$ N.; long. $63^{\circ} 31' 30''$ W., 683 fathoms, yl. m. fine. s.; temp. 39.75° F.

Albatross station 2351, Jan. 21, 1885, lat. $22^{\circ} 41' 00''$ N.; long. $84^{\circ} 16' 30''$ W., 426 fathoms.

Albatross station 2383, Mar. 3, 1885, lat. $28^{\circ} 32' 00''$ N.; long. $88^{\circ} 06' 00''$ W., 1,181 fathoms, br. gn. m.; temp. 39.8° F.

AMPHIPHOLIS SQUAMATA (Delle Chiaje).¹

St. Thomas; A. H. Riise.

Family OPHIACANTHIDÆ.

OPHIACANTHA STELLATA Lyman.

Albatross station 2327, Jan. 17, 1885, lat. $23^{\circ} 11' 45''$ N.; long. $82^{\circ} 17' 54''$ W., 182 fathoms, fine. br. s.

Albatross station 2331, Jan. 17, 1885, lat. $23^{\circ} 10' 31''$ N.; long. $82^{\circ} 19' 55''$ W., 114 fathoms, co.

¹ Labeled by Lyman, *Amphiura tenera* Lütken.

OPHIACANTHA ASPERA Lyman.

Off Havana, Cuba; *Albatross*.*Albatross* station 2321, Jan. 17, 1885, lat. $23^{\circ} 10' 54''$ N.; long. $82^{\circ} 18' 00''$ W., 230 fathoms, fine gy. s.*Albatross* station 2337, Jan. 19, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W., 199 fathoms, co.

OPHIACANTHA TROSCHELI Lyman.

Albatross station 2354, Jan. 22, 1885, lat. $20^{\circ} 59' 30''$ N.; long. $86^{\circ} 23' 45''$ W., 130 fathoms, co.OPHIACANTHA (OPHIOPRISTIS) HIRSUTA Lyman.¹*Albatross* station 2335, Jan. 19, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W., 204 fathoms.OPHIACANTHA (OPHIOTRETA) SERTATA Lyman.²*Albatross* station 2359, Jan. 29, 1885, lat. $20^{\circ} 19' 10''$ N.; long. $87^{\circ} 03' 30''$ W., 231 fathoms, wh. co.; temp. 50.8° F.OPHIOLIMNA MIXTA (Lyman).³*Albatross* station 2136, Feb. 29, 1884, lat. $17^{\circ} 43' 40''$ N.; long. $75^{\circ} 38' 25''$ W., 52 fathoms, co. brk. sh.*Albatross* station 2156, Apr. 30, 1884, lat. $23^{\circ} 10' 35''$ N.; long. $82^{\circ} 21' 55''$ W., 278 fathoms, co.*Albatross* station 2159, Apr. 30, 1884, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 08''$ W., 98 fathoms, co.*Albatross* station 2167, May 1, 1884, lat. $23^{\circ} 10' 40''$ N.; long. $82^{\circ} 20' 30''$ W., 201 fathoms, co.*Albatross* station 2321, Jan. 17, 1885, lat. $23^{\circ} 10' 54''$ N.; long. $82^{\circ} 18' 00''$ W., 230 fathoms, fine gy. s.*Albatross* station 2327, Jan. 17, 1885, lat. $23^{\circ} 11' 45''$ N.; long. $82^{\circ} 17' 54''$ W., 182 fathoms, fine br. s.*Albatross* station 2333, Jan. 19, 1885, lat. $23^{\circ} 10' 36''$ N.; long. $82^{\circ} 19' 12''$ W., 169 fathoms, fine wh. co.*Albatross* station 2334, Jan. 19, 1885, lat. $23^{\circ} 10' 42''$ N.; long. $82^{\circ} 18' 24''$ W., 67 fathoms, wh. co.*Albatross* station 2335, Jan. 19, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W., 204 fathoms.*Albatross* station 2337, Jan. 19, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W., 199 fathoms, co.*Albatross* station 2338, Jan. 19, 1885, lat. $23^{\circ} 10' 40''$ N.; long. $82^{\circ} 20' 15''$ W., 189 fathoms, co.*Albatross* station 2345, Jan. 20, 1885, lat. $23^{\circ} 10' 40''$ N.; long. $82^{\circ} 20' 15''$ W., 184 fathoms, fine gy. wh. co.*Albatross* station 2349, Jan. 20, 1885, lat. $23^{\circ} 10' 40''$ N.; long. $82^{\circ} 20' 15''$ W., 182 fathoms, co.*Albatross* station 2353, Jan. 22, 1885, lat. $20^{\circ} 59' 00''$ N.; long. $86^{\circ} 23' 00''$ W., 167 fathoms, co.¹ Labeled by Lyman, *Ophiacantha hirsuta*.² Labeled by Lyman, *Ophiacantha sertata*.³ Labeled by Lyman, *Ophiocoma mixta*.

Albatross station 2354, Jan. 22, 1885, lat. $20^{\circ} 59' 30''$ N.; long. $86^{\circ} 23' 45''$ W., 130 fathoms, co.

OPHIOMITRA VALIDA Lyman.

Albatross station 2129, Feb. 27, 1884, lat. $19^{\circ} 56' 04''$ N.; long. $75^{\circ} 48' 55''$ W., 274 fathoms, bu. m. fne. s.

Albatross station 2152, Apr. 30, 1884, $2\frac{1}{2}$ miles NW. of Havana Light, 387 fathoms, co.; temp. 49° F.

Albatross station 2153, Apr. 30, 1884, lat. $23^{\circ} 10' 19''$ N.; long. $82^{\circ} 23' 10''$ W., 283 fathoms, co.; temp. 55.8° F.

Albatross station 2159, Apr. 30, 1884, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 08''$ W., 98 fathoms, co.

Albatross stations 2162, 2164, 2167, Apr. 30 to May 1, 1884, lat. $23^{\circ} 10' 30''$ – $40''$ N.; long. $82^{\circ} 20' 25''$ – $30''$ W., 122–201 fathoms, co.

Albatross station 2169, May 1, 1884, lat. $23^{\circ} 10' 28''$ N.; long. $82^{\circ} 20' 27''$ W., 78 fathoms, co.

Albatross station 2327, Jan. 17, 1885, lat. $23^{\circ} 11' 45''$ N.; long. $82^{\circ} 17' 54''$ W., 182 fathoms, fne. br. s.

Albatross station 2335, Jan. 19, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W., 204 fathoms.

Albatross station 2342, Jan. 19, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W., 201 fathoms, co.

Albatross station 2347, Jan. 20, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W., 216 fathoms, co.

OPHIOMITRA EXIGUA Lyman.

Albatross station 2342, Jan. 19, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W., 201 fathoms, co.

OPHIOMITRA CHELYS (Wyville Thomson).

Albatross station 2117, Jan. 27, 1884, lat. $15^{\circ} 24' 40''$ N.; long. $63^{\circ} 31' 30''$ W., 683 fathoms, yl. m. fne. s.; temp. 39.75° F.

OPHIOMITRA DIPSACOS Lyman.

Albatross station 2355, Jan. 22, 1885, lat. $20^{\circ} 56' 48''$ N.; long. $86^{\circ} 27' 00''$ W., 399 fathoms, yl. oz.

OPHIOCAMAX HISTRIX Lyman.

Albatross station 2130, Feb. 27, 1884, lat. $19^{\circ} 56' 25''$ N.; long. $75^{\circ} 49' 49''$ W., 175 fathoms, gy. m. s. brk. sh.

Albatross station 2134, Feb. 27, 1884, lat. $19^{\circ} 56' 06''$ N.; long. $75^{\circ} 47' 32''$ W., 254 fathoms.

Albatross station 2135, Feb. 27, 1884, lat. $19^{\circ} 55' 58''$ N.; long. $75^{\circ} 47' 07''$ W., 250 fathoms, hrd. co.

Albatross station 2143, Mar. 23, 1884, lat. $9^{\circ} 30' 45''$ N.; long. $76^{\circ} 25' 30''$ W., 155 fathoms, gn. m.

Albatross station 2152, Apr. 30, 1884, $2\frac{1}{2}$ miles NW. of Havana Light, 387 fathoms, co.; temp. 49° F.

Albatross station 2157, Apr. 30, 1884, lat. $23^{\circ} 10' 04''$ N.; long. $82^{\circ} 21' 07''$ W., 29 fathoms.

Albatross station 2159, Apr. 30, 1884, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 08''$ W., 98 fathoms, co.

Albatross station 2161, Apr. 30, 1884, lat. $23^{\circ} 10' 36''$ N.; long. $82^{\circ} 20' 28''$ W.,
146 fathoms, co.

Albatross station 2162, Apr. 30, 1884, lat. $23^{\circ} 10' 30''$ N.; long. $82^{\circ} 20' 25''$ W.,
122 fathoms, co.

Albatross station 2164, May 1, 1884, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 29''$ W.,
192 fathoms, co.

Albatross station 2167, May 1, 1884, lat. $23^{\circ} 10' 40''$ N.; long. $82^{\circ} 20' 30''$ W.,
201 fathoms, co.

Albatross station 2169, May 1, 1884, lat. $23^{\circ} 10' 28''$ N.; long. $82^{\circ} 20' 27''$ W.,
78 fathoms.

Albatross station 2321, Jan. 17, 1885, lat. $23^{\circ} 10' 54''$ N.; long. $82^{\circ} 18' 00''$ W.,
230 fathoms, fne. gy. s.

Albatross station 2327, Jan. 17, 1885, lat. $23^{\circ} 11' 45''$ N.; long. $82^{\circ} 17' 54''$ W.,
182 fathoms, fne. br. s.

Albatross station 2341, Jan. 19, 1885, lat. $23^{\circ} 11' 00''$ N.; long. $82^{\circ} 19' 06''$ W.,
143 fathoms, co.

Albatross station 2342, Jan. 19, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W.,
201 fathoms, co.

Albatross station 2350, Jan. 20, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W.,
213 fathoms, co.

Family OPHIICOMIDÆ.

OPHIICOMA ECHINATA (Lamarck).

Nassau, Bahamas; J. I. and A. R. Northrop.

Tortugas, Florida; D. W. Whitehurst.

St. Thomas; A. H. Riise.

St. Thomas; *Albatross*.

Old Providence; *Albatross*.

Cozumel; *Albatross*.

Curaçao; *Albatross*.

OPHIICOMA RIISEI Lütken.

Florida Keys; Suckley, Sternbergh, and Rowell.

Key West, Florida; *Albatross*.

St. Thomas; *Albatross*.

Belize, Honduras; W. A. Stanton.

Curaçao; *Albatross*.

Albatross station 2138, Feb. 29, 1884, lat. $17^{\circ} 44' 05''$ N.; long. $75^{\circ} 39' 00''$ W.,
23 fathoms, co. brk. sh.

Albatross station 2146, Apr. 2, 1884, lat. $9^{\circ} 32' 00''$ N.; long. $79^{\circ} 54' 30''$ W.,
34 fathoms, brk. sh.

Albatross station 2159, Apr. 30, 1884, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 08''$ W.,
98 fathoms, co.

Albatross station 2168, May 1, 1884, lat. $23^{\circ} 10' 36''$ N.; long. $82^{\circ} 20' 20''$ W.,
122 fathoms, co.

Albatross station 2323, Jan. 17, 1885, lat. $23^{\circ} 10' 51''$ N.; long. $82^{\circ} 19' 03''$ W.,
163 fathoms, wh. br. co.

OPHIOCOMA PUMILA Lütken.

Nassau, Bahamas; J. I. and A. R. Northrop.

St. Thomas; A. H. Riise.

St. Thomas; *Albatross*.

Belize, Honduras; W. A. Stanton.

Curaçao; *Albatross*.*Albatross* station 2138, Feb. 29, 1884, lat. $17^{\circ} 44' 05''$ N.; long. $75^{\circ} 39' 00''$ W., 23 fathoms, co. brk. sh.*Albatross* station 2167, May 1, 1884, lat. $23^{\circ} 10' 40''$ N.; long. $82^{\circ} 20' 30''$ W., 201 fathoms, co.*Albatross* station 2168, May 1, 1884, lat. $23^{\circ} 10' 36''$ N.; long. $82^{\circ} 20' 20''$ W., 122 fathoms, co.*Albatross* station 2324, Jan. 17, 1885, lat. $23^{\circ} 10' 25''$ N.; long. $82^{\circ} 20' 24''$ W., 33 fathoms, co.; temp. 79.1° F.

Family OPHIOTHRIXIDÆ.

OPHIOTHRIX ANGULATA (Say).Key West, Florida; *Albatross*.Jamaica; *Albatross*.St. Thomas; *Albatross*.St. Thomas; A. H. Riise.¹Old Providence; *Albatross*.Curaçao; *Albatross*.*Albatross* station 2120, Jan. 30, 1884, lat. $11^{\circ} 07' 00''$ N.; long. $62^{\circ} 14' 30''$ W., 73 fathoms, bu. m.*Albatross* station 2136, Feb. 29, 1884, lat. $17^{\circ} 43' 40''$ N.; long. $75^{\circ} 38' 25''$ W., 52 fathoms, co. brk. sh.*Albatross* station 2138, Feb. 29, 1884, lat. $17^{\circ} 44' 05''$ N.; long. $75^{\circ} 39' 00''$ W., 23 fathoms, co. brk. sh.*Albatross* station 2160, Apr. 30, 1884, lat. $23^{\circ} 10' 31''$ N.; long. $82^{\circ} 20' 37''$ W., 167 fathoms, co.*Albatross* station 2167, May 1, 1884, lat. $23^{\circ} 10' 40''$ N.; long. $82^{\circ} 20' 30''$ W., 201 fathoms, co.*Albatross* station 2168, May 1, 1884, lat. $23^{\circ} 10' 36''$ N.; long. $82^{\circ} 20' 20''$ W., 122 fathoms, co.*Albatross* station 2315, Jan. 15, 1885, lat. $24^{\circ} 26' 00''$ N.; long. $81^{\circ} 48' 15''$ W., 37 fathoms, co.*Albatross* station 2317, Jan. 15, 1885, lat. $24^{\circ} 25' 45''$ N.; long. $81^{\circ} 46' 45''$ W., 45 fathoms, co.; temp. 75° F.*Albatross* station 2362, Jan. 30, 1885, lat. $22^{\circ} 08' 30''$ N.; long. $86^{\circ} 53' 30''$ W., 25 fathoms, co. s.*Albatross* station 2363, Jan. 30, 1885, lat. $22^{\circ} 07' 30''$ N.; long. $87^{\circ} 06' 00''$ W., 21 fathoms, wh. r. co.*Albatross* station 2365, Jan. 30, 1885, lat. $22^{\circ} 18' 00''$ N.; long. $87^{\circ} 04' 00''$ W., 24 fathoms, wh. r. co.¹ Lyman had labeled 7 specimens, *Ophiothrix violacea*.

Albatross station 2366, Jan. 30, 1885, lat. $22^{\circ} 28' 00''$ N.; long. $87^{\circ} 02' 00''$ W., 27 fathoms, fine wh. co.

Albatross station 2370, Feb. 7, 1885, lat. $29^{\circ} 18' 15''$ N.; long. $85^{\circ} 32' 00''$ W., 25 fathoms, crs. gy. s. brk. sh.

Albatross station 2371, Feb. 7, 1885, lat. $29^{\circ} 17' 00''$ N.; long. $85^{\circ} 30' 45''$ W., 26 fathoms, crs. gy. s. brk. sh.

Albatross station 2372, Feb. 7, 1885, lat. $29^{\circ} 15' 30''$ N.; long. $85^{\circ} 29' 30''$ W., 27 fathoms, g.

Albatross station 2373, Feb. 7, 1885, lat. $29^{\circ} 14' 00''$ N.; long. $85^{\circ} 29' 15''$ W., 25 fathoms, co.

Albatross station 2387, Mar. 4, 1885, lat. $29^{\circ} 24' 00''$ N.; long. $88^{\circ} 04' 00''$ W., 32 fathoms, s. g. brk. sh.

Albatross station 2405, Mar. 15, 1885, lat. $28^{\circ} 45' 00''$ N.; long. $85^{\circ} 02' 00''$ W., 30 fathoms, gy. s. brk. co.

Albatross station 2406, Mar. 15, 1885, lat. $28^{\circ} 46' 00''$ N.; long. $84^{\circ} 49' 00''$ W., 26 fathoms, crs. s. co.

Albatross station 2408, Mar. 16, 1885, lat. $28^{\circ} 28' 00''$ N.; long. $84^{\circ} 25' 00''$ W., 21 fathoms, co.

Albatross station 2411, Mar. 18, 1885, lat. $26^{\circ} 33' 30''$ N.; long. $83^{\circ} 15' 30''$ W., 27 fathoms, fine wh. s. bk. sp.

Albatross station 2412, Mar. 19, 1885, lat. $26^{\circ} 18' 30''$ N.; long. $83^{\circ} 08' 45''$ W., 27 fathoms, fine gy. s. bk. sp. brk. sh.

Albatross station 2413, Mar. 19, 1885, lat. $26^{\circ} 00' 00''$ N.; long. $82^{\circ} 57' 30''$ W., 24 fathoms, fine s. bk. sp. brk. sh.

Albatross station 2418, Apr. 2, 1885, lat. $33^{\circ} 20' 00''$ N.; long. $77^{\circ} 05' 00''$ W., 90 fathoms, gy. s.; temp. 65.8° F.

OPHIOTHRIX GERSTEDII Lütken.

San Antonio, Cuba; *Albatross*.

St. Thomas; A. H. Riise.

OPHIOTHRIX LINEATA Lyman.

Albatross station 2411, Mar. 18, 1885, lat. $26^{\circ} 33' 30''$ N.; long. $83^{\circ} 15' 30''$ W., 27 fathoms, fine wh. s. bk. sp.

OPHIOTHRIX SUENSONII Lütken.

St. Thomas, A. H. Riise.

Carthagen, Colombia; A. Schott.

Albatross station 2138, Feb. 20, 1884, lat. $17^{\circ} 44' 05''$ N.; long. $75^{\circ} 39' 00''$ W., 23 fathoms, co. brk. sh.

Albatross station 2146, Apr. 2, 1884, lat. $9^{\circ} 32' 00''$ N.; long. $79^{\circ} 54' 30''$ W., 34 fathoms, brk. sh.

Albatross station 2322, Jan. 17, 1885, lat. $23^{\circ} 10' 54''$ N.; long. $82^{\circ} 17' 45''$ W., 115 fathoms, co.

Albatross station 2354, Jan. 22, 1885, lat. $20^{\circ} 59' 30''$ N.; long. $86^{\circ} 23' 45''$ W., 130 fathoms, co.

Albatross station 2414, Mar. 19, 1885, lat. $25^{\circ} 04' 30''$ N.; long. $82^{\circ} 59' 15''$ W., 26 fathoms, fine wh. s. brk. sh.

Family OPHIOSCOLECIDÆ.

OPHIOSCIASMA GRANULATUM Lyman.

Albatross station 2136, Feb. 29, 1884, lat. $17^{\circ} 43' 40''$ N.; long. $75^{\circ} 38' 25''$ W., 52 fathoms, co. brk. sh.

Albatross station 2161, Apr. 30, 1884, lat. $23^{\circ} 10' 36''$ N.; long. $82^{\circ} 20' 28''$ W., 146 fathoms, co.

OPHIOGERON SUPINUS Lyman.

Albatross station 2343, Jan. 19, 1885, lat. $23^{\circ} 11' 35''$ N.; long. $82^{\circ} 19' 25''$ W., 279 fathoms, fne. co.

Family OPHIOCHONDRIDÆ.

OPHIOCHONDRUS CONVOLUTUS Lyman.

Albatross station 2152, Apr. 30, 1884, $2\frac{1}{2}$ miles NW. of Havana Light, 387 fathoms, co.; temp. 49° F.

OPHIOCHONDRUS CRASSISPINUS Lyman.

Albatross station 2152, Apr. 30, 1884, $2\frac{1}{2}$ miles NW. of Havana Light, 387 fathoms, co.; temp. 49° F.

Family OPHIOMYXIDÆ.

OPHIOMYXA FLACCIDA (Say).

Key West, Florida; *Albatross*.

Tortugas, Florida; D. W. Whitehurst.

St. Thomas; A. H. Riise.

St. Thomas; *Albatross*.

Curaçao; *Albatross*.

Albatross station 2138, Feb. 29, 1884, lat. $17^{\circ} 44' 05''$ N.; long. $75^{\circ} 39' 00''$ W., 23 fathoms, co. brk. sh.

Albatross station 2146, Apr. 2, 1884, lat. $9^{\circ} 32' 00''$ N.; long. $79^{\circ} 54' 30''$ W., 34 fathoms, brk. sh.

Albatross station 2147, Apr. 2, 1884, lat. $9^{\circ} 32' 20''$ N.; long. $79^{\circ} 54' 45''$ W., 34 fathoms, co.; temp. 78.5° F.

Albatross station 2167, May 1, 1884, lat. $23^{\circ} 10' 40''$ N.; long. $82^{\circ} 20' 30''$ W., 201 fathoms, co.

Albatross station 2333, Jan. 19, 1885, lat. $23^{\circ} 10' 36''$ N.; long. $82^{\circ} 19' 12''$ W., 169 fathoms, fne. wh. co.

OPHIOMYXA TUMIDA Lyman.

Albatross station 2162, Apr. 30, 1884, lat. $23^{\circ} 10' 30''$ N.; long. $82^{\circ} 20' 25''$ W., 122 fathoms, co.

Albatross station 2316, Jan. 15, 1885, lat. $24^{\circ} 25' 30''$ N.; long. $81^{\circ} 47' 45''$ W., 50 fathoms; temp. 74° F.

Albatross station 2317, Jan. 15, 1885, lat. $24^{\circ} 25' 45''$ N.; long. $81^{\circ} 46' 45''$ W., 45 fathoms, co.; temp. 75° F.

Albatross station 2318, Jan. 15, 1885, lat. $24^{\circ} 25' 45''$ N.; long. $81^{\circ} 46' 00''$ W., 45 fathoms, co.; temp. 75° F.

Albatross station 2321, Jan. 17, 1885, lat. $23^{\circ} 10' 54''$ N.; long. $82^{\circ} 18' 00''$ W., 230 fathoms, fne. gy. s.

Albatross station 2322, Jan. 17, 1885, lat. $23^{\circ} 10' 54''$ N.; long. $82^{\circ} 17' 45''$ W., 115 fathoms, co.

Albatross station 2327, Jan. 17, 1885, lat. $23^{\circ} 11' 45''$ N.; long. $82^{\circ} 17' 54''$ W., 182 fathoms, fne. br. s.

Albatross station 2330, Jan. 17, 1885, lat. $23^{\circ} 10' 48''$ N.; long. $82^{\circ} 19' 15''$ W., 121 fathoms, fne. gy. co.

Albatross station 2337, Jan. 19, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W., 199 fathoms, co.

Albatross station 2342, Jan. 19, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W., 201 fathoms, co.

Albatross station 2345, Jan. 20, 1885, lat. $23^{\circ} 10' 40''$ N.; long. $82^{\circ} 20' 15''$ W., 184 fathoms, fne. gy. wh. co.

Albatross station 2346, Jan. 20, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W., 200 fathoms, co.

Albatross station 2347, Jan. 20, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W., 216 fathoms, co.

Albatross station 2348, Jan. 20, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W., 211 fathoms, co.

Albatross station 2358, Jan. 29, 1885, lat. $20^{\circ} 19' 00''$ N.; long. $87^{\circ} 03' 30''$ W., 222 fathoms, fne. wh. co.

Albatross station 2415, Apr. 1, 1885, lat. $30^{\circ} 44' 00''$ N.; long. $79^{\circ} 26' 00''$ W., 440 fathoms, co. crs. s. sh. for.

OPHIOYRSA SERPENS Lyman.

Albatross station 2162, Apr. 30, 1884, lat. $23^{\circ} 10' 30''$ N.; long. $82^{\circ} 20' 25''$ W., 122 fathoms, co.

Albatross station 2166, May 1, 1884, lat. $23^{\circ} 10' 36''$ N.; long. $82^{\circ} 20' 30''$ W., 196 fathoms, co.; temp. 71.9° F.

Albatross station 2331, Jan. 17, 1885, lat. $23^{\circ} 10' 31''$ N.; long. $82^{\circ} 19' 55''$ W., 114 fathoms, co.

Albatross station 2333, Jan. 19, 1885, lat. $23^{\circ} 10' 36''$ N.; long. $82^{\circ} 19' 12''$ W., 169 fathoms, fne. wh. co.

Family OPHIOBRACHIONTID.E.

OPHIOBRACHION UNCINATUS Lyman.

Albatross station 2319, Jan. 17, 1885, lat. $23^{\circ} 10' 37''$ N.; long. $82^{\circ} 20' 06''$ W., 143 fathoms, gy. co.

Albatross station 2346, Jan. 20, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W., 200 fathoms, co.

Family HEMIEURYALID.E.

SIGSBEIA MURRHINA Lyman.

Albatross station 2120, Jan. 30, 1884, lat. $11^{\circ} 07' 00''$ N.; long. $62^{\circ} 14' 30''$ W., 73 fathoms, bu. m.

Albatross station 2136, Feb. 29, 1884, lat. $17^{\circ} 43' 40''$ N.; long. $75^{\circ} 38' 25''$ W., 52 fathoms, co. brk. sh.

Albatross station 2138, Feb. 29, 1884, lat. $17^{\circ} 44' 05''$ N.; long. $75^{\circ} 39' 00''$ W., 23 fathoms, co. brk. sh.

Albatross station 2157, Apr. 30, 1884, lat. $23^{\circ} 10' 04''$ N.; long. $82^{\circ} 21' 07''$ W., 29 fathoms.

Albatross station 2159, Apr. 30, 1884, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 08''$ W., 98 fathoms, co.

Albatross station 2161, Apr. 30, 1884, lat. $23^{\circ} 10' 36''$ N.; long. $82^{\circ} 20' 28''$ W., 146 fathoms, co.

Albatross station 2164, May 1, 1884, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 29''$ W., 192 fathoms, co.

Albatross station 2167, May 1, 1884, lat. $23^{\circ} 10' 40''$ N.; long. $82^{\circ} 20' 30''$ W., 201 fathoms, co.

Albatross station 2168, May 1, 1884, lat. $23^{\circ} 10' 36''$ N.; long. $82^{\circ} 20' 20''$ W., 122 fathoms, co.

Albatross station 2322, Jan. 17, 1885, lat. $23^{\circ} 10' 54''$ N.; long. $82^{\circ} 17' 45''$ W., 115 fathoms, co.

Albatross station 2324, Jan. 17, 1885, lat. $23^{\circ} 10' 25''$ N.; long. $82^{\circ} 20' 24''$ W., 33 fathoms, co.; temp. 79.1° F.

Albatross station 2330, Jan. 17, 1885, lat. $23^{\circ} 10' 48''$ N.; long. $82^{\circ} 19' 15''$ W., 121 fathoms, fne. gy. co.

Albatross station 2333, Jan. 19, 1885, lat. $23^{\circ} 10' 36''$ N.; long. $82^{\circ} 19' 12''$ W., 169 fathoms, fne. wh. co.

Albatross station 2334, Jan. 19, 1885, lat. $23^{\circ} 10' 42''$ N.; long. $82^{\circ} 18' 24''$ W., 67 fathoms, wh. co.

Albatross station 2336, Jan. 19, 1885, lat. $23^{\circ} 10' 48''$ N.; long. $82^{\circ} 18' 52''$ W., 157 fathoms, co.

Albatross station 2337, Jan. 19, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W., 199 fathoms, co.

Albatross station 2338, Jan. 19, 1885, lat. $23^{\circ} 10' 40''$ N.; long. $82^{\circ} 20' 15''$ W., 189 fathoms, co.

Albatross station 2342, Jan. 19, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W., 201 fathoms, co.

Albatross station 2345, Jan. 20, 1885, lat. $23^{\circ} 10' 40''$ N.; long. $82^{\circ} 20' 15''$ W., 184 fathoms, fne. gy. wh. co.

Albatross station 2346, Jan. 20, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W., 200 fathoms, co.

Albatross station 2347, Jan. 20, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W., 216 fathoms, co.

Albatross station 2348, Jan. 20, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W., 211 fathoms, co.

Albatross station 2349, Jan. 20, 1885, lat. $23^{\circ} 10' 40''$ N.; long. $82^{\circ} 20' 15''$ W., 182 fathoms, co.

Albatross station 2354, Jan. 22, 1885, lat. $20^{\circ} 59' 30''$ N.; long. $86^{\circ} 23' 45''$ W., 130 fathoms, co.

EURYALÆ.

Family ASTROCHEMIDÆ.

ASTROCHEMA OLIGACTES (Pallas).

Albatross station 2129, Feb. 27, 1884, lat. $19^{\circ} 56' 04''$ N.; long. $75^{\circ} 48' 55''$ W., 274 fathoms, bu. m. fine. s.

Albatross station 2133, 2134, Feb. 27, 1884, lat. $19^{\circ} 55' 55''$ to $56' 06''$ N.; long. $75^{\circ} 48' 03''$ to $47' 32''$ W., 254-290 fathoms, wh. s. brk. sh.

Albatross station 2135, Feb. 27, 1884, lat. $19^{\circ} 55' 58''$ N.; long. $75^{\circ} 47' 07''$ W., 250 fathoms, hrd. co.

Albatross station 2159, Apr. 30, 1884, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 08''$ W., 98 fathoms, co.

Albatross station 2323, Jan. 17, 1885, lat. $23^{\circ} 10' 51''$ N.; long. $82^{\circ} 19' 03''$ W., 163 fathoms, wh. br. co.

Albatross station 2347, Jan. 20, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W., 216 fathoms, co.

Albatross station 2348, Jan. 20, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W., 211 fathoms, co.

ASTROCHEMA LÆVE (Lyman).

Albatross station 2131, Feb. 27, 1884, lat. $19^{\circ} 56' 44''$ N.; long. $75^{\circ} 50' 49''$ W., 202 fathoms, hrd. crs. s.

Albatross station 2330, Jan. 17, 1885, lat. $23^{\circ} 10' 48''$ N.; long. $82^{\circ} 19' 15''$ W., 121 fathoms, fine. gy. co.

Albatross station 2349, Jan. 20, 1885, lat. $23^{\circ} 10' 40''$ N.; long. $82^{\circ} 20' 15''$ W., 182 fathoms, co.

ASTROCHEMA TENUE Lyman.

Off Havana, Cuba, *Albatross*.

Albatross station 2322, Jan. 17, 1885, lat. $23^{\circ} 10' 54''$ N.; long. $82^{\circ} 17' 45''$ W., 115 fathoms, co.

Albatross station 2330, Jan. 17, 1885, lat. $23^{\circ} 10' 48''$ N.; long. $82^{\circ} 19' 15''$ W., 121 fathoms, fine. gy. co.

Albatross station 2332, Jan. 19, 1885, lat. $23^{\circ} 10' 38''$ N.; long. $82^{\circ} 20' 06''$ W., 156 fathoms, wh. gy. co.

Albatross station 2335, Jan. 19, 1885, lat. $23^{\circ} 10' 39''$ N.; long. $82^{\circ} 20' 21''$ W., 204 fathoms.

ASTROCHEMA BRACHIATUM Lyman.

Albatross station 2127, Feb. 25, 1884, lat. $19^{\circ} 45' 00''$ N.; long. $75^{\circ} 04' 00''$ W., 1,639 fathoms, gn. m.

ASTROCHEMA INTECTUM Lyman.

Albatross station 2161, Apr. 30, 1884, lat. $23^{\circ} 10' 36''$ N.; long. $82^{\circ} 20' 28''$ W., 146 fathoms, co.

Albatross station 2349, Jan. 20, 1885, lat. $23^{\circ} 10' 40''$ N.; long. $82^{\circ} 20' 15''$ W., 182 fathoms, co.

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